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AVIATION

Est. 1916 . . . McGraw-Hill Publishing Company, Inc.

The Oldest American Aeronautical Magazine

EDWARD P. WARNER, *Editor*

LOUIS F. STOLL, *Publishing Director*

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Contents for November, 1932

NOVEMBER, 1932

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Above — Streamlined even to its landing-gear struts, this fastest of all Boeing pursuit ships — built in 1932 — is a radical new development. An all-metal, low-wing single-seater, powered with a new-type supercharged Wasp.

Left — Pioneer pullman of the air — the Boeing "80," built in 1928 — the nation's first long-distance, night-flying, multi-motored passenger plane to operate on regular schedule. Used on the transcontinental route of United Air Lines.

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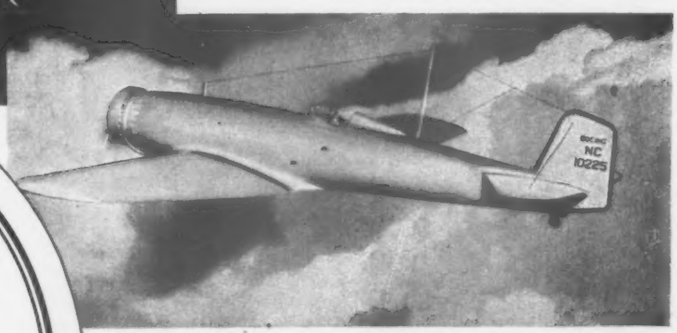
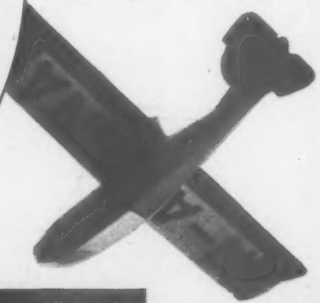
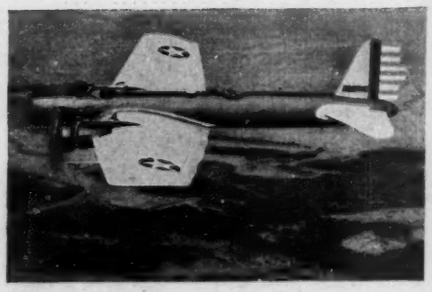


Above — 2300 pounds payload — at 160 m.p.h.! The famous 1929 Boeing Monomail — first successful "smooth-skin" commercial plane ever built, first with retractable landing gear.



Above—This first Boeing flying boat, 1919, outlasted 7 engines, flew more than 500,000 miles, and was *still airworthy!*

Right — 9,500,000 miles since 1927 — a record made by the faithful Boeing Forties on the Chicago-San Francisco run.



Above—This Boeing bomber—built in 1931—broke all speed records of previous planes in its class. Crew of five . . . more than a ton of bombs!

Right — Pioneer aerobats made the F2B-1 famous! The first high-powered, air-cooled carrier fighter ever built (1927) — selected by the Three Sea Hawks, the Navy's crack aerobatic team.

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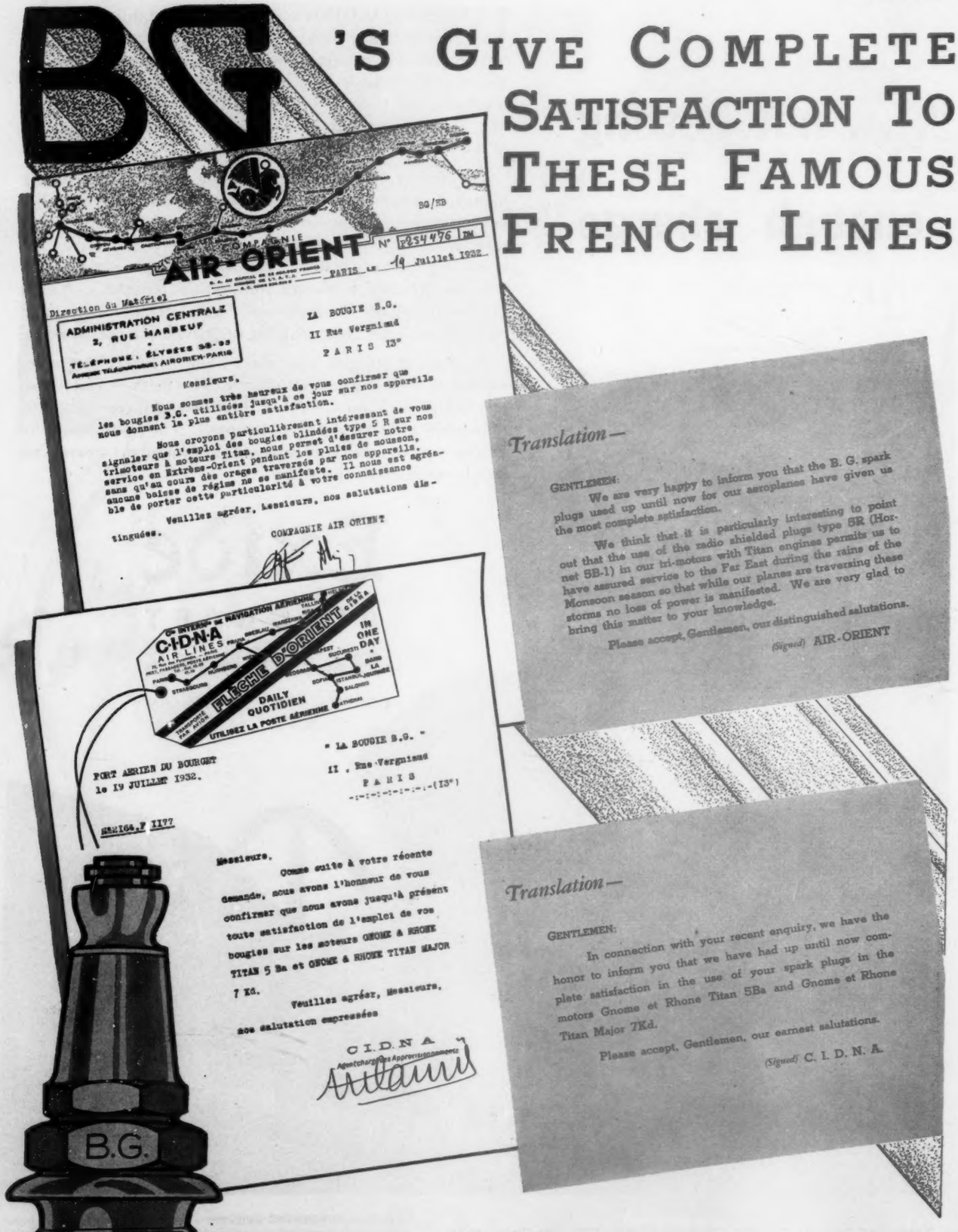
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Translation—

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We think that it is particularly interesting to point out that the use of the radio shielded plugs type SR (Hornet SB-1) in our tri-motors with Titan engines permits us to have assured service to the Far East during the rains of the Monsoon season so that while our planes are traversing these storms no loss of power is manifested. We are very glad to bring this matter to your knowledge.

Please accept, Gentlemen, our distinguished salutations.

(Signed) AIR-ORIENT

Translation—

GENTLEMEN:

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Please accept, Gentlemen, our earnest salutations.

(Signed) C. I. D. N. A.

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AVIATION
FOR NOVEMBER, 1932

Is there a limit on speed?

By Edward P. Warner

Editor of AVIATION

EVERYONE is interested in speed. Transport lines are clamoring for cruising speeds approaching 200 m.p.h. in the immediate future and indefinitely increased thereafter. To the military pilot, it may be literally a matter of life and death to be able to outspeed the enemy. Private owners demand steadily increasing speed, to increase the range of usefulness of their personal transportation and for its sheer thrill. There is a small but select group that are casting covetous eyes on next year's awards of the Bendix and Thompson trophies. The industry is besieged from all sides with a demand for faster ships, for racing and for general service.

That great pioneer of aviation, Louis Bleriot, has posted a prize for the first flight at better than 500 miles an hour. Major Doolittle, felicitating Mr. Haizlip on breaking Doolittle's own transcontinental record, is reported to have looked into the crystal and foretold further reductions of the coast-to-coast time until a speed of 600 m.p.h. should have been reached. Popular magazines of a more or less "scientific" nature have illumined their pages with drawings of odd-looking aircraft of Martian tinge, their artists' conceptions of the types with which we would be able to breakfast in New York and lunch in Berlin, or something of that sort.

This seems like a good time to try and lay a foundation of solid fact upon which we can plant our feet in talking about prospective high-speed development.

I have no idea of trying to set an ultimate limit to speed. It would be inconceivably foolish to do that, unless some definite natural law of practical physical limitation can be found at a definite point, and there is no indication that anything of that sort exists. Wholly unpredictable developments of the future might make any limiting figure look ridiculous. At most one may be justified in saying: "Thus-and-so is the rate of growth that can reasonably be expected over the next few years." I shall not go even that far, but I can be very definite along another line. I can say, in paraphrase of a favorite expression in Broadway's current vocabulary: "This is the limit, unless ———." I can say with some positiveness that certain things will have to be done to attain 500 m.p.h. and certain other things to attain 600 m.p.h., and I shall then be able to talk of the

Airplane characteristics vs. speed

Name	Type	Year	Max. Speed V	Gross Weight lb. W	Hp. P	Wing Area S	W/S	W/P	P/S	K
Wright	Box-kite pusher biplane	1908	32	992	24	538	1.84	41.3	0.045	90
Curtiss	Box-kite pusher biplane	1909	47	.....	50	320	.....	.....	0.156	87
Deperdussin	Streamlined monoplane	1912	105	991	100	97	10.20	9.91	1.03	104
Curtiss	Army bi-landplane racer	1922	224	2,110	460	139	15.16	4.58	3.31	150
Savoia-Marchetti	Mono-seaplane	1922	142	2,378	300	247	9.62	7.92	1.21	133
Verville-Sperry	Mono-landplane	1922	191	2,225	400	150	14.82	5.56	2.66	138
Curtiss NCR3	Bi-seaplane	1925	246	2,710	619	142	19.10	4.37	4.36	150
Curtiss R3C	Bi-landplane	1925	264	.....	610	148	.....	.....	4.12	164
Macchi M-39	Mono-seaplane	1926	261	3,560	880	156	22.80	4.05	5.64	147
Supermarine S-5	Mono-seaplane	1927	308	3,242	870	115	28.20	3.73	7.57	157
Short Crusader	Mono-seaplane radial eng	1927	260	2,520	870	122	20.62	2.89	7.14	135
Gloster IV	Bi-seaplane	1927	305	3,200	850	130	24.60	3.76	7.08	159
Supermarine S-6	Mono-seaplane	1929	357	5,240	1,950	145	36.10	2.69	13.45	150
Supermarine S-6B	Mono-seaplane	1931	408	5,995	2,700	147	40.70	2.22	18.30	154
Laird Supersolution	Bi-landplane	1931	268	2 480	530	112	22.15	4.64	4.74	160
G. B. Supersport	Mono-landplane	1931	269	2,280	535	88	25.90	4.26	6.08	147
G. B. Supersport	Mono-landplane	1932	294	.....	750	90	.....	.....	8.34	145
Wedel-Williams	Mono-landplane	1932	277	.....	535	106	.....	.....	5.05	161
Monocoupe (Warner)	Cabin mono-landplane	1931	142	1,620	110	132	12.30	14.70	0.834	151
Monomail-Boeing	Cabin mono-landplane*	1931	158	8,000	575	525	15.00	13.91	1.10	153
Pilgrim 100	Cabin mono-landplane	1931	136	7,750	575	549	16.90	13.50	1.25	126
Consolidated Fleetster	Cabin mono-landplane	1931	180	5,600	575	313	17.80	9.80	1.84	147
Lockheed Orion	Cabin mono-landplane*	1931	190	5,200	450	275	18.70	11.50	1.63	161
Curtiss Condor	Cabin bi-landplane — 2 eng	1930	145	17,900	1,270	1,510	11.85	14.10	0.84	154
Boeing Bomber	Military mono-landplane*	1931	.....	.....	.....	.....	.....	.....	.....	160
Curtiss P-6-E	Military bi-landplane	1930	193	.....	640	262	.....	.....	2.44	143

*Including the area cut off by the fuselage except in the Gee Bees where only half the fuselage area was counted.

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feasibility of attaining either of those speeds by any given time in terms of definite degrees of advance in particular elements of the aeronautical and mechanical engineering arts.

Our first step is the usual one in studies of high-speed performance, that to the familiar formula:

$$V_{max} = K\sqrt[3]{\frac{P}{S}}$$

If we can find the data for estimating the probable limits within which K is likely to lie, we can read off directly the horsepower per square foot needed for any particular speed.

At this point we have to draw upon experience. Experience is summarized in the table on page 431, where we have brought together the principal characteristics determining the performance of some twenty airplanes, including representatives of commercial and military ships of recent design, the last two Thompson Trophy winners, a couple of the Pulitzer racers of ten years ago, and all the post-war Schneider winners. In the case of the commercial ships, the performances are furnished by the manufacturer and may not all be determined with equal accuracy. For the racing planes and the military planes the speeds can of course be considered as absolutely reliable.

Seven years of progress

The values of K in the table speak for themselves. Despite six years of exhaustive study on the aerodynamics of racing speed planes, the winner of the last Schneider race showed an advance of approximately 5 per cent over the biplane with which Doolittle scored in Baltimore in 1925. Recent racing planes with radial engines have not yet shown values for K as high as had been attained with the water-cooled racers of seven years ago. On the other hand, the very highest figure recorded is that of a radial engine in a commercial type, a machine large enough and heavy enough so that a proper streamline fuselage could be built behind the engines and still not be of unduly large dimensions in proportion to the wing. It is, in fact, noteworthy that the highest values of K are not attained with planes of the very highest speed or power. Certainly no machine has ever been built in which more attention was lavished on aerodynamic detail than in the Supermarine racers that have captured the last three Schneider events. If they have failed to show record-breaking values of K, it is in part because of the handicap of floats, which cost about fifteen to twenty units in K as compared with a retracting landing gear, partly because the enormous engines require fuselages of very large size in proportion to the wings. The derivation of the fundamental speed formula depends on the assumption that all planes have the same ratio of parasite resistance to wing drag. It is not a bad assumption on the whole, but obviously it can't be completely accurate, and in particular it works against showing a very high apparent efficiency on a ship of very high speed. The indication that K has increased but 5 per cent in seven years of Schneider racing is a little misleading. As racing design has progressed, the designer has found himself in the state of the occupants of the enchanted forest into which the Red Queen took Alice, and having to run very fast indeed in order to stay in the same place. As engines have grown constantly larger in the search for a higher value of $\frac{P}{S}$, and so for a higher speed, it has been necessary to introduce more and more aerodynamical refinements in order to prevent K from falling off, to say nothing of increasing it by any substantial amount.

In particular, other things being equal, K tends to fall off steadily with increasing wing loading after a certain point. The 1927 Schneider winner (upon which much more information is available than on any of its successors) had a wing loading of 28 lb. per sq.ft. and a K of 157. If the wing area had been halved, making no other change except to reduce the wing bracing and tail area proportionately, the speed would have increased only 8 per cent and K would have been cut to 134.

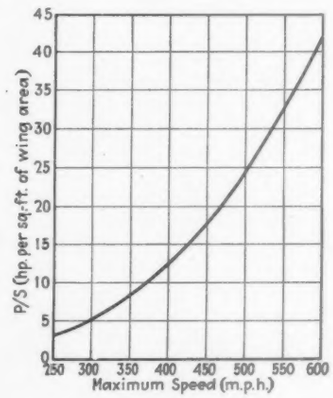


Fig. 1

With all that in mind, it seems unlikely that K can be raised very much farther with anything at all resembling the existing types of airplanes. Taking the Schneider figures as a base, one may find reason to hope that K might be lifted to 162 in the course of the next few years on a prestone-cooled seaplane intended for pure racing service. I am cautious enough to refrain from proposing any absolute limits upon that point, but certainly every per cent of improvement at that region and beyond will be won from much sweat of the designer's brow. If there is improvement in K beyond that level, coupled with very high wing loadings, it will be of the order of a very few per cent.

Prospects for landplanes

Landplanes, with a retractable or a well-streamlined landing gear, ought to do a little better. In the particular case of the 1927 Schneider Supermarine, if the floats could simply have been eliminated and replaced by a landing gear having a total resistance equal to that of the float struts (which is a reasonable assumption), K would have been increased fifteen units, or to 166. Unfortunately the process is not quite as simple as that. The fixed floats of the seaplane supply a better base for the wing bracing than can be had on a landplane. They serve as fuel tanks, and they may even have to be used, if power should be further increased or wings clipped any farther, to give additional cooling surface. The fuel tanks alone constitute a serious problem on a ship of really high speed if space must be found for them in the fuselage. Upon the whole, it seems generous to assume that K might be lifted to 173 for a landplane with a very high wing loading. It is worth noting, incidentally, that if an airplane could be made to consist of nothing but a Clark Y wing, with no fuselage, power-plant, tail surfaces, landing gear, or wing bracing, and if the propeller efficiency were 80 per cent, the value of K would be 215. In raising K to 173 on a machine with Clark Y wings, we should have to cut the total parasite resistance down to an "equivalent flat-plate area" of just under 1 per cent of the wing area, or, on a strictly modern racing machine, about 1 sq.ft. On the 1927 Supermarine, with an engine and fuselage considerably smaller than in the 1931 design, the equivalent flat-plate area for the fuselage and tail alone, taking no account of the wing bracing, to say nothing of the floats, was .65 sq.ft. In the 1931 ship it appears to have been approximately 40 per cent more. To raise K to 173, therefore, it would be necessary to build a machine with a pure cantilever wing, of a section of no greater resistance than the Clark Y, and a fully retracted landing gear, which would have a fuselage and tail surface resistance about equal to that of the 1931 Schneider machine. To put the same thing in other terms, to raise K for the Lockheed Orion to 173, it would be necessary to total parasite resistance by 30 per cent, —certainly a formidable task.

With maximum values of K determined, we can move on to $\frac{P}{S}$ and to Fig. 1, where maximum speed has been plotted against the horsepower per square foot of area required to secure it for a landplane of the greatest imaginable aerodynamic cleanness in accordance with the specifications of the previous paragraph.

To interpret the $\frac{P}{S}$ curve in terms of

a type of airplane that has to be constructed to attain a given speed, we have to make some assumption about the wing loading. Wing loading is, of course, fixed by the limitation placed on take-off and landing qualities. Over the last twenty years the loading on racing machines has been worked up gradually from about 12 lb. per sq.ft. to approximately 40. Landing speed has increased from around 60 m.p.h. in the high-speed champion of the immediately pre-war period to about 110 m.p.h. now. How much farther the development may be carried is frankly difficult to prophesy, but it seems to me that it is unlikely to go beyond 50 lb. per sq.ft. which would give a landing speed of 120 m.p.h., for some time to come. It might conceivably be raised even to 60 lb. per sq.ft., but it is quite inconceivable that values of K as high as have been assumed could be maintained with any such wing loading. Evidence on that point has already been furnished in connection with the 1927 Supermarine. Not only does it inevitably reduce K to increase the wing loading beyond 18 lb. per sq.ft. or thereabouts, but devices for reducing the wing surface in flight or otherwise varying the lift are of relatively little value. It is hardly conceivable that any mechanism of that sort, however perfect, could add more than 3 per cent to a racing ship's speed.

It seems, in short, extremely liberal to assume as high a value of K as 173 with a wing loading as high as 50 lb. per sq.ft., and no such figure could be reached with any power-plant even remotely resembling those now built, unless the wing area was at least 120 sq.ft. To clip the wings beyond that point, and then to attach them to a fuselage containing an engine of power high enough to give any such maximum speed as we are discussing, would inevitably drop K to well below the level that has been suggested as a working basis. Since Fig. 1 indicates a requirement of 24 hp. per sq.ft. of wing area at 500 m.p.h., it follows that to secure that speed it would be necessary to use 2,900 hp. at the very minimum. To get 600 m.p.h., on the same basis, would need at least 5,000 hp.

The power plant problem

Assuming a wing loading of 50 lb. per sq.ft., the curve of $\frac{P}{S}$ can be converted into one of maximum allowable weight per horsepower, as in Fig. 2 (the dotted curve on the same chart applies to the case of racing seaplanes, with K taken as 162). The break in the curve is accounted for by a lowering of the wing loading where the power loading goes above 5.6 lb. per sq.ft., in order that the reserve power may not fall too low for safety. A 100 per cent reserve on maximum power (or

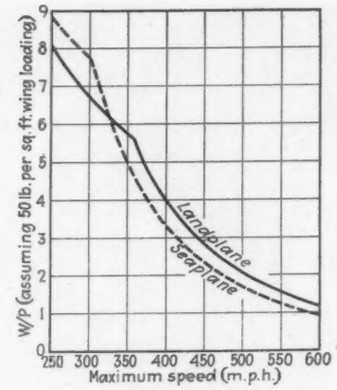


Fig. 2

67 per cent for the seaplane), corresponding to a ceiling of 15,000 ft., has been taken as another fundamental limiting condition, but that has no effect at speeds above 360 m.p.h. on the curve.

It is worth remarking, to show that this chart becomes fairly reasonable in the light of current practice, that it would permit a theoretical maximum power loading of 3.1 per hp. for 408 m.p.h. with a seaplane and 6.7 lb. for 300 m.p.h with a landplane, whereas the actual power loadings of the Supermarine and Gee Bee machines which have approximately accomplished those figures were only 2.2 and 3.2, respectively.

A racing landplane must put about 27 per cent of its gross weight into structure. The proportion required for wings and fuselage and so on hasn't changed greatly in the last ten years, and it seems unlikely that it will change very much in the near future. For a seaplane, with the weight of the floats to be taken into account, the proportion of structural weight must run to about 35 per cent. The weight of the pilot is almost a negligible factor on a plane with 2,000 hp. or more, but it may be taken as 0.06 lb. per hp. on the average. Fuel and oil and the tanks to contain them are likely to continue to run at least 0.46 lb. per hp.hr., and it is fair to assume that all racing machines will be calculated for a maximum radius of 350 miles at maximum speed (which would mean only 35 minutes in the air for the fastest ships that we are considering). Subtracting all those items, the amount of weight remaining for the power-plant, cooling system, and propeller at speeds from 350 to 600 m.p.h. is plotted in Fig. 3. The solid

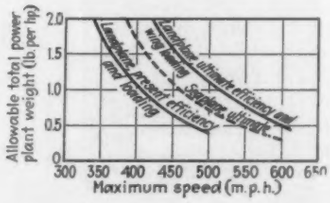


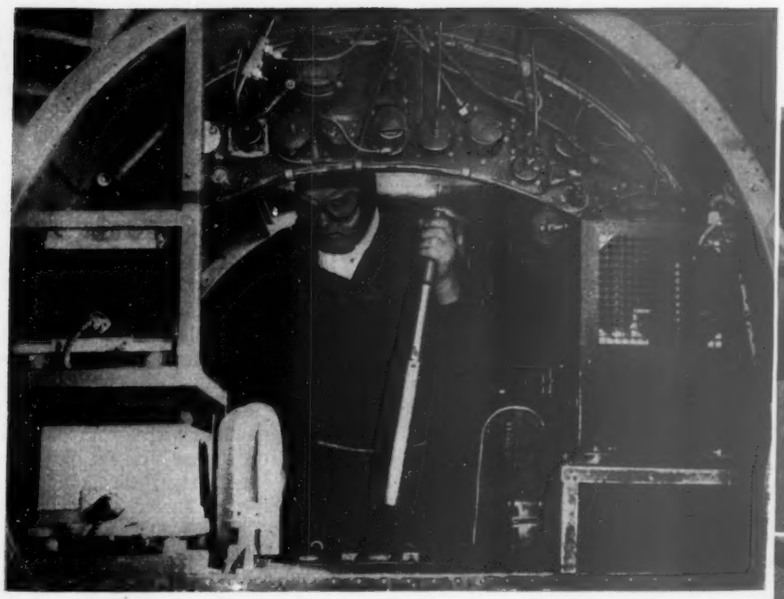
Fig. 3

curve again represents landplanes, the dotted one seaplanes. A third curve has been added to show the power-plant weights that would have to be attained if the entire burden of progress were to be thrown on the engine designer, the maximum value of K being taken as 156 (which is about the peak for present-day racing types) and the wing loading as 30 lb. per sq.ft.

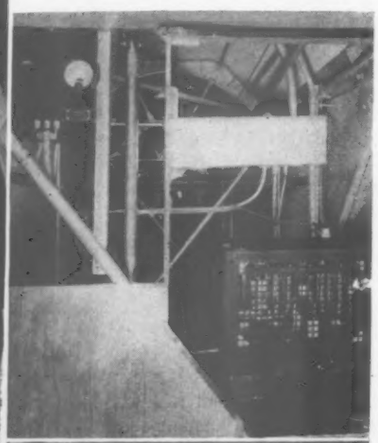
The curves are largely self-explanatory. If an airplane with aerodynamic characteristics only slightly better, and wing loading only a little higher, than those of the best racing landplanes of 1932 is to attain 500 m.p.h. it must do it by the use of a power-plant which weighs, complete with all its accessories, only 0.40 lb. per hp.,—a power-plant which seems likely to be some distance in the future. If, on the other hand, the parasite resistance and the wing drag per unit of area can be further reduced, as compared with present standards, by about twice as large a percentage as the total of all the cuts in resistance made during the past decade. and if the landing-speed be allowed to rise to 120 m.p.h., 500 m.p.h. can be attained with a power-plant weight as high as 1.1 lb. per hp.,—just about the equal of the best figure so far reached.

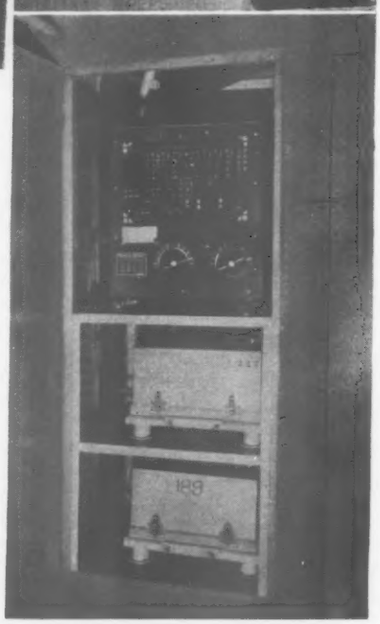
The "sprint" Rolls-Royce engine installed in the 1931 Schneider winner for its straightaway record trials had a gross weight, including the wing radiators and all the other accessories, of 0.95 lb. per hp. The Napier engine that won in 1927 weighed, with its accessories, 1.6 lb. per hp. Taking the rate of progress into account it seems probable that another five years of work on racing engines as intensive as that carried on in England from 1926 to 1931 would bring the power-plant down to 0.70 lb. per hp. If that were done, in conjunction with the aerodynamic improvements already specified, a maximum speed of 500 m.p.h. for seaplanes and 560 m.p.h. for landplanes would be possible. The landplane that makes 560 m.p.h. (when, as and if) will have to have 120 sq.ft. of wing surface, an engine of 4,100 hp. installed in a fuselage of not more than 10 sq.ft. maximum cross-sectional area, prestone cooling with flush wing radiators (or air-cooling with a 4,100 hp. engine not over 40 in. in diameter), and a gross weight of 6,000 lb., of which 2,900 would be in the power-plant. It may not be an impossible set of specifications, but surely anyone will agree that it is an impressive one.

Four hundred and sixty miles an hour with a landplane seems to be well within reach at the present time, on the basis of known engineering data, for anyone who wants to spend a million dollars or thereabouts in getting it. Beyond that point every mile of increase will require new discovery. Every mile will have to be fought for.

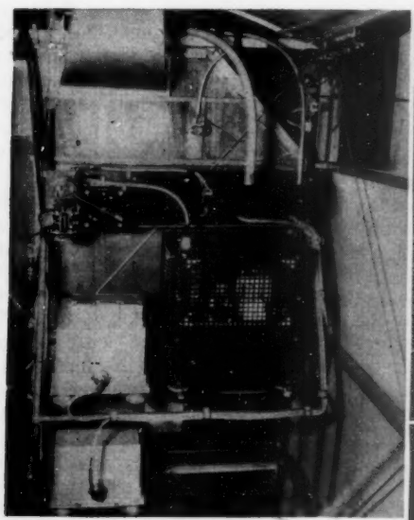


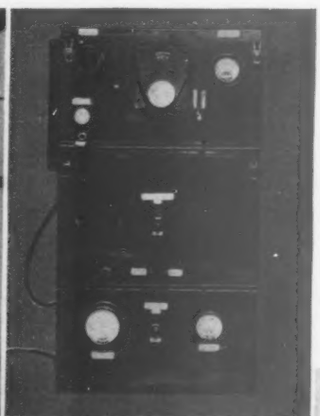
Below: Western Electric transmitter and tuning unit in the tail of an American Airway's Pilgrim.





Above: Worm's-Eye view of the cockpit of a Transcontinental & Western Air Northrop mail plane showing installation of Western Electric two-way radio equipment. The transmitter is at the right. Lower left is the long wave receiver, and upper left the short wave receiver. Direct tuning is employed. Below, left: Installation of Western Electric two-way radio equipment in a Boeing 80-A transport operated on the Chicago-San Francisco division of United Air Lines. Below, right: Front and rear views of combination aircraft radio transmitter and receiver units, developed and built by Eastern Air Transport, Inc. The top section encloses a Stromberg-Carlson Model D receiver with a dual coil set which can be used for either beacon reception or two-way reception. The transmitter in the center section is an R.C.A 10-15 watt-combination telephone and telegraph transmitter. The dynamotor in the bottom section supplies high voltage for both receiver and transmitter.





Above: Compact installation of Western Electric two-way radio equipment on a T. & W. A. Ford. Below: Mechanic adjusting Stromberg receiver on an E.A.T. night-flying Mailwing.

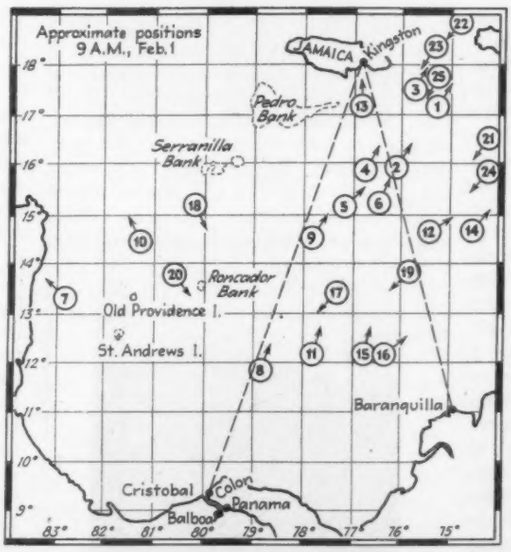
Radio in transport

The operations and maintenance divisions of Pan American Airways have been described in previous issues and no less important is the communications system. Unlike that of any domestic airline, this branch of the service must provide absolute accuracy in the dissemination of forecasts of sudden and violent weather changes by means of radio handicapped by the necessity of operation in the static-ladened atmosphere of the tropics. The enviable record of regularity and safety established by Pan American in the face of a multitude of operating problems is an excellent testimonial to a system that was designed and built exclusively by Pan American engineers and is totally different from any other in the Western Hemisphere.

Communications on an international airline

THE observation and interpretation of weather information, and the operation of a communications system by which that data and the messages of all the company's units may be transmitted, are essential functions in the daily routine of any airline. They become even more important when the line operates far from centers of population and with little or no assistance from local governments in the form of ground aids to navigation or weather intelligence.

Four years ago when Pan American began laying groundwork for extensive operations of international air transport service between the United States, the Caribbean, Central and South America, they faced unusual problems in the matter of airway construction (which on international airlines must be done at the operators' own expense) as they were working an area in which there were few suitable airports, no intermediate landing fields and no operating facilities. The only available communications facilities were less speedy than the planes themselves, and due to the lack of co-ordinated effort extending over any appreciable distance, weather observing and reporting services of a degree of thoroughness to be valuable to air transport were practically unknown. In addition, there was no aircraft radio equipment which could tackle the job of communications which Pan American had to contend with. To contact the operating aircraft was considered vitally essential as one of the basic Pan American operating problems, and exhaustive weather reports were demanded by the rigid rules set up for the safety and dependable operation of Pan American aircraft. Like the problem of airway construction, the airline system had to solve the difficult problem of communications for itself without assistance from either the United States or local governmental agencies. The solution of the problem of radio and weather service was worked out to satisfy peculiar and variable reuirements which differ in many respects from those faced by domestic airlines which involve no international complications.



Location and direction of surface shipping furnished P.A.A. pilots before each flight over the Caribbean.

The weather and communications services of Pan American Airways System must be given much of the credit for the success of that company in maintaining regular service along a 22,000-mile airway through 31 countries. Pan American maintains its own complete weather department. It is headed by Mr. Brandts, a former government meteorological expert who has headquarters at Pan American's winter base at Miami, in the same building as the Miami radio station of the company. He has a staff of expert assistants, and a corps of helpers including every airport manager and ground radio operator in the company's employ. All of these men are qualified weather observers, originally trained at Miami in a two-week course and instructed further in a two-week refresher course at vacation time each year.

Local weather services are available at a few points. The Cuban Government, for instance, co-operates with Pan American through its Havana observatory. The U. S. Marine Station in Port au Prince provides data, also, but most of the information has to be collected by the company's own observers. Upper air stations are located at important airports and at certain critical points, such as Pachuca in the mountains between Tampico and Mexico City. Upper-air stations are equipped with a portable hydrogen gas generator, imported from France, for inflating the pilot balloons. An instrument of this type is essential

in the isolated stations where upper air observations are desired and which lack commercial hydrogen.

Collecting the weather

The company's weather system in Brazil is so extensive that Pan American handles all the meteorological services and forecasting for that country. Weather reports are collected at Rio de Janeiro from all points south of a parallel through Para, and at Miami, from all points north of that line. Each division headquarters receives weather reports from each station in its area three times a day, and uses them for the compilation of forecasts for the next day and for working planes along the airways. The operating department, including the pilots, have the additional benefit of up-to-the-minute weather reports from point to point along the airway as a given plane progresses over its route, beginning with a special report five minutes before the take-off. While a plane is in the air it is being worked by at least two radio stations ahead and two behind along the course. The pilot reports his position at half-hourly intervals and receives weather data at similar periods, while the radio operator calls a ground station every fifteen minutes. The weather is checked particularly when the plane is halfway between airports, so that the pilot can turn back if the weather ahead is not favorable. Weather reports to the planes are given at more frequent intervals when the weather gets thick, and in particularly poor flying conditions they are made as frequently as every five minutes. The weather data radioed from plane to the ground is used by the ground officials in working other planes in that area.

Special attention is paid, of course, to indications of serious changes or sudden disturbances. Any change from previous reports is noted and announced, if it is of a certain duration and of certain degree. The appearance of a thunderstorm or squall at a station or within sight of one is reported to headquarters with the least possible delay. Changes in visibility, height and amount of clouds, volume of precipitation and force of wind are reported if the changes are along certain defined lines and of sufficient duration to indicate a trend.

A visibility change is reported if the visibility is decreasing and becomes less than 1,100 yd.; when it decreases still further and becomes less than 220 yd.; when, after having been less than 220 yd., it increases and becomes more than 550 yd. for at least ten minutes. A change in cloud altitude is reported when the ceiling falls below 600 ft.; when it continues still lower and falls below 150 ft.; and when, having been below 150 ft., it has lifted and remained above 300 ft. for at least ten minutes.

A report is made, of course, when rain, snow, hail or sleet begin to fall or, after falling, has cleared for the usual minimum period of ten minutes. Wind force changes are reported when they reach 7 on the Beaufort scale (40-mile wind) or go still further and reach 9 (60-mile), or decrease to 6 (35-mile) and remain below that point for ten minutes after having exceeded 8 (50-mile). The adoption of the Beaufort scale as a standard makes it easier to work with surface vessels, as few mariners are accustomed to thinking of the wind in terms of its velocity.

Shipping co-operation

Weather data over the Caribbean often are secured from surface steamers, and paid for at commercial rates. Pilots about to leave Kingston, Cristobal or Barranquilla are furnished mimeographed charts showing the steamers along the route, their approximate location, and the call letters of their radio sets. This information may be used to obtain special weather data or for emergency.

Pan American is confronted with weather phenomena different in a number of respects from those faced by the domestic airlines. The company has two particularly troublesome weather periods to deal with—the hurricane season, July 15-Oct. 15, and the period of "northers" Dec. 15-April 15. Fog and clouds are common to both the tropics and the temperate zones. Though sleet and snow are absent, except in the Andes where Pan American-Grace operates, those afflictions are replaced by wind and rain storms of extraordinary suddenness and intensity. Nevertheless, schedules are maintained almost to perfection during the rainy season despite the downpours. The engineering department has devised protection for vulnerable engine parts against water, and pilots fly through blinding rain as a matter of course; fog and cloud flying by instruments is commonplace also. In all this, however, it is imperative that the pilot know exactly the extent of the storm along the course, and whether or not the destination is clear for a safe landing. The intelligence is supplied by weather and radio services. Fortunately, many tropical showers are of brief duration and cover a comparatively small area.

An isolated weather reporting station on the Mexico-Tampico route.

A study in hurricanes

Hurricanes are the outstanding storm phenomena affecting Pan American's operations. Not only do they affect the safety of flying operations, but they require that the company be ready to engage in rescue work; they often blow the ocean up onto the land and inundate flying fields, and they lay all except the most solid structures flat on the ground. The weather department therefore studied them exhaustively over a period of two years and put itself in a position to forecast their occurrence and path. Pan American probably knows more about hurricane phenomena in the Caribbean region than any one official weather bureau therein, and the knowledge has already contributed a great deal to the operating and safety records of the company.

The Belize hurricane is an outstanding example. Pan American observed the hurricane and forecast that it would strike Belize at a certain time. The natives pooh-poohed the warnings, but Pan American ordered a San Salvador-Havana plane to advance its schedule so as to clear the danger zone by the zero hour. The plane got through by a safe margin, and the hurricane struck Belize as forecast. The Pan American radio system often is the means of first communication between points struck by disaster and the outside world. Communities struck by hurricanes have been vastly aided in their emergencies by the company's system and by the relief brought in by air on the company's planes.

Other special weather conditions have been subjected to intensive study. An upper-air station was established on a barge for investigation of prevailing wind forces and directions at various altitudes on the airways between Paramaribo and Natal. The investigation revealed that strong following winds could be obtained at 14,000 ft. on the southbound journey and at 5,000 ft. northbound. Since 14,000 ft. is not a desirable altitude at which to fly a heavy plane with passengers, the next best

level having a helping wind, about 1,500 ft., was chosen.

Broadcasting the weather

Hand in hand with the weather service goes the radio system. It does no good to collect information unless it can be delivered with absolute certainty, and the tropics produce a particularly high-powered brand of static. Exhaustive research in the field of aircraft radio, suitable for the particular conditions obtaining in Pan American territory, started in 1927 with commercially manufactured sets, but tests of both radiophone and radio-telegraph installations on the Miami-Havana and Havana-San Juan runs were not successful. In 1929 the company decided to set up its own department for the design and manufacture of radio equipment. Mr. H. C. Leuteritz was placed in charge of this work as general communications engineer, which position he occupies today. He began by making a detailed study of all radio equipment available for airline use, both in this country and abroad, and from his studies developed Pan American's efficient and widespread radio network in the Caribbean and South American areas.

Code versus voice

The early decision to adopt radio-telegraphy rather than radio telephony has remained the basic policy of the communications system. Operating in the tropics, over wide stretches of open water where no established ground stations were available, put the communications problem on an entirely different basis than that of any of the domestic airlines. The code system has proven to be the most satisfactory for the particular operating conditions involved for code signals can cut through static better than can the voice, and the use of abbreviations and short groups of letters to represent whole messages often makes the telegraph speedier than the phone. Beyond this the use of code allows regular communication with surface shipping, which is an important point where long overwater jumps are undertaken.

It has also been adopted as a fixed policy that the airplane pilot be relieved of all responsibility in connection with communication. This means the addition of a radio operator to the crew of each plane. On some of the smaller ships the duties of the radio operator devolve upon the co-pilot or flight mechanic, but on the large flying boats of the S-40 or the Commodore class, and the tri-motored land planes, an operator is assigned whose duties are concerned entirely with the radio and with weather reporting. The weight of the radio man (Pan American Airways will not consider an applicant for such a position who weighs over 140 lb.) is offset by a saving of weight in the equipment itself. Where the average voice transmission and receiving equipment of the current transport type weighs in the neighborhood of 200 to 250 lb. complete, the installed weight of apparatus for code transmission and reception is in the neighborhood of 60 lb. The combined weight, therefore, of the equipment and the operator is equal to, or somewhat under the installed weight of the equivalent radio-telephone set. The salary of radio operators is written off as a form of insurance for the absolute safety of the airplane and its personnel.

H. C. Leuteritz, P.A.A. communications engineer

Another important point in favor of code communication engendered by the special circumstances under which Pan American Airways operates, has to do with the length of time the airplane's radio set may be operated under emergency conditions after a forced landing. The current required by the average telephone transmitter is so high that once the supply from the generators has been cut off due to engine failure, the storage batteries will allow intermittent operation of the transmitter for a period of 45 minutes at the most before the batteries become completely discharged. The code transmitter on the other hand, requires just about one-tenth the current supply of the telephone set, so that under the same conditions intermittent operation may be conducted for a period upwards of eight hours. In the remote event of a plane being forced down far out at sea, the importance of this factor can readily be appreciated.

Equipment home built

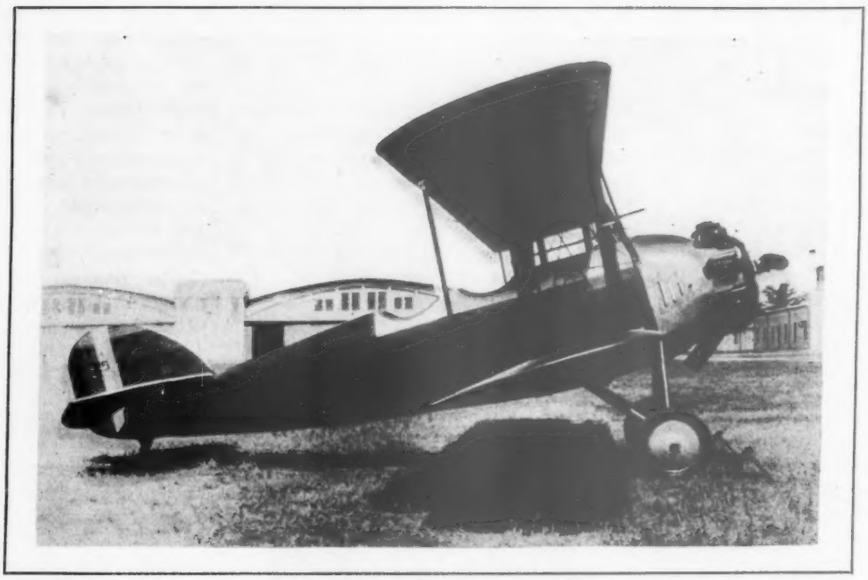
All ground and airplane radio equipment is built at Miami. The airplane transmitter has an output of 12 watts, and is fitted with five plug-in coils for quick changing of wavelengths. A special break-in relay is fitted to afford faster communication between the plane and the ground. The aluminum cabinet in which the set is mounted is 13 in. wide, 9¼ in. high and 8¼ in. deep. The front panel is hinged so that the interior may be quickly and easily inspected. The entire transmitter including the cabinet, is coated with a solution impervious to heat and moisture, otherwise the tropical atmospheric conditions to which it is exposed would quickly attack the parts and render the set useless. The whole device weighs but 12 lb.

The receiver weighs 10½ lb. and is about the same size as the transmitter. Its circuit consists of one stage of radio frequency amplification, a detector, and two stages of audio amplification. All tubes are of the A.C. type. This receiver has a fairly high gain, permitting the reception of weak signals over long distances. Ignition interference is not sufficiently bothersome to prevent the normal reception of airport signals over distances of 400 to 500 miles, even though shielded spark plugs are not employed. The front panel of the receiver contains two dials, the right one for controlling regeneration, and the left for tuning. Plug-in coils are provided to permit reception on 32, 54, 97 and 600 meters.

Plate voltages are supplied by a regular 135-volt aircraft B battery. The regular 12-volt, 65 ampere-hour storage battery carried for lighting and starting purposes supplies current in case of a forced landing. Engine or wind-driven generators keep the batteries charged to capacity at all times. As indicated above, it is good for at least eight hours emergency operation. A dynamotor weighs 16 lb., and a wind-driven generator 11 lb.

All landplanes of the company are equipped with trailing antenna only; boats and amphibions have both fixed and trailing antenna. The landplanes are able to maintain communication in case of forced landing by stretching the antenna from the plane to a tree or improvised pole. The fixed antenna enables communication when the boat or amphibion is riding on the surface of the water. Trailing antenna must be carried in all machines, however, because the instrument must be capable under international regulations of operating on the 500 and 333 kc. frequencies. The trailing antenna must be long enough so that it can be resonated to these frequencies.

The Pan American equipment has been developed to a high degree of dependability. Each set is expected to remain in the plane with only routine servicing attention as long as the plane's engines are operated between major overhauls, about 250 hours. There are now 59 radio and weather ground stations distributed throughout the Pan American system, and all of the 102 aircraft operated by the company are completely equipped with receiving and sending apparatus.



A typical foreign airplane having American equipment. The Packard diesel engine and Hamilton Standard propeller are used on this Rumanian machine.

American aircraft products abroad

By Fowler W. Barker

Assistant Chief, Aeronautics Trade Division
Department of Commerce, Aeronautics Branch
Washington, D. C.

STATISTICS alone will not tell the dramatic tale of the steady penetration of American aeronautical products into operations in every corner of the world. Over 50 American aircraft engines are now employed in carrying passengers and mail between the Netherlands and the Dutch colonies in the East Indies. They are used on the Japan-Korea-Manchuria line, and they have hauled thousands of pounds of machinery from the seaport to the isolated gold mines of New Guinea. American airplanes have supplanted the trans-Andean railway. Engines from our factories propell aircraft from the highest airport in the world, La Paz, in Bolivia, where the populace comes naturally by airmindedness, for the airport is 12,500 ft. above sea level. The increased airline schedules in China, which now include a route from Shanghai through the terrifically difficult Yangtse Gorges to Chungking, employ American equipment. In Siam the air force is using high-powered single-seater fighters of American manufacture.

Speed for European transport

A scheduled air route operating in Canada to a point over 1,000 miles above the Arctic Circle employs U. S. aircraft, as does also a Swiss airline which now maintains schedules averaging 166 miles an hour, a transport speed never before approached in Europe. The Netherlands East Indian air force uses planes of American design and engines of American manufacture. Finland, and more recently Poland and Lithuania, employ American engines in locally built aircraft. So does the ship-to-shore air mail service of the fast German trans-Atlantic liners. American parachutes are used by the air services of over 30 countries, including Great Britain, Poland, Cuba, Brazil and Siam. Aircraft wheels, brakes, shock-absorbing struts, tires, and instruments from American factories are being employed as standard equipment on an ever growing number of aircraft of foreign manufacture. During the first six months of 1932 a prominent Egyptian purchased an American sport plane; one was sold in the Union of South Africa and one in New Zealand, with orders received from the former country for two more.

With an estimated production of 722 aircraft during the first half of 1932 and export shipments totaling 61, the percentage of exports to production was 8.4 per cent as compared with 4.2 per cent for the first half of last year. Exports decreased only 10.2 per cent from 1931, production 55 per cent. The American industry is counting on export business to a greater extent than heretofore. Domestic orders are limited now, and worth-while dividends are now being received on the work done in cultivating the export market when domestic demand was high.

The value of American exports of

aircraft, aircraft engines and parts and accessories during the first half of 1932 was $1,470,020 with an additional $165,659 for parachutes and parachute parts shipments (totaling $1,635,679) as compared with a value of $2,703,670 of aeronautical exports for the first half of 1931. (Parachutes and parachute parts figures were unavailable for the earlier period, not being segregated from a general classification for products of silk and linen not elsewhere specified in the export classifications.)

It is often claimed for European countries, and especially for Great Britain, that they have gained a commanding position in the export field. Although on the surface the British official figures show up more favorably than those for the United States, they are not comparable, for Great Britain includes shipments to its military units in its colonies and possessions. Furthermore, as just noted, American figures in the past have not included parachutes, nor have they included tires shipped separately or certain aircraft instruments, all of which articles are fitted under non-aeronautical headings in the general classification of foreign trade.

Comparisons are difficult

The American tabulations include only sales to overseas customers, and do not consider shipments of military aviation equipment to the Philippines, the Canal Zone, and the Hawaiian Islands. The British figures for the full year 1931, on the other hand, indicate that fully half of the British exports are of military equipment to such territories as India, Australia and New Zealand and to countries and mandates in the British sphere of influence such as Egypt and Palestine. The remainder would be substantially the American totals. A similar situation affects the aeronautics export figures of France, which include shipments to her colonies and possessions.

Another factor making the statistics of U. S. aviation shipments incomparable with those of European countries is the invisible export due to the manufacture of aircraft, engines, parts and accessories abroad. France, Germany, Canada, Turkey, Argentina, the Netherlands, Chile and Japan are among the countries manufacturing American aviation products under license.

Hong Kong was the principal market for complete American aircraft in point of total valuation, for the first half of 1932. Of six planes shipped, at an average unit valuation of $31,632, five were high-powered observation planes and one an all-metal tri-engined transport. All of these were transshipped from Hong Kong into China proper. Canada, with twelve aircraft at the comparatively low unit average valuation of $5,203, imported some transports and some low-priced light aircraft for sport and instruction purposes. The low unit value of the shipments to Canada is accounted for in part by the fact that American engines are manufactured under license in Canada and some of the higher-priced aircraft were powered by engines produced in Canada. Certain engine parts shipped to licensees in partially fabricated form, are exported under classifications other than the aeronautics categories.

The market in Mexico, so far this year, has taken planes to be used on the Mexican airlines and some planes for school use in the State of Chihuahua. Turkey was the destination for six training aircraft at an average unit value of $8,540. A substantial shipment of civil and military types is expected to go forward shortly from the United States to Turkey. Brazil was the customer for six aircraft, at a unit average value of $7,696, to go into service on the government-operated mail line. One commercial plane shipped to the Philippines, at the comparatively high value of $32,500 is believed to be an amphibian for use on an inter-island service. A Japanese owner, after surveying the entire world for planes available for his purpose, bought an American model for $20,400. The minor markets remaining purchased either very light aircraft or used planes and gliders, with the exception of New Zealand, which took four gliders and one four-passenger cabin model for use by a flying club.

The Netherlands again appear as leading purchaser of United States aircraft engines, taking 24 at an average unit value of $4,442 during the first half of this year. They went to the Dutch K.L.M. airline, mainly for the Eurasian route, longest air line in the world. The Russian figures are fantastic—491 engines of an average unit value of $93. Four hundred and seventy-four of them were of low present cost, being surplus stocks of 1917 and 1918 manufacture. During the first half of the year, however, some high-powered American engines were ordered by Soviet Russia for service on the Berlin-Moscow route. Mexico purchased 49 engines for airline replacement and for installation in planes of American design produced in the local factory. Germany figures among the leading markets for American aero engines, using them on some of its transports.

Where the exports go

Country of Destination	Jan.-June 1932 Value
Hong Kong	$190,560
Japan	135,705
Netherlands	131,411
Canada	131,168
Mexico	111,927
Germany	87,149
Brazil	85,490
Sweden	84,450
Belgium	68,913
Soviet Russia in Europe	64,840
Turkey	51,765
China	42,280
Philippine Islands	39,471
Trinidad and Tobago	29,332
Peru	27,891
Panama	22,455
Cuba	22,061
United Kingdom	19,863
Argentina	16,757
Colombia	11,383
Czechoslovakia	11,378
Latvia	10,400
Honduras	10,262
France	8,686
Spain	7,356
Other Netherland East Indies	6,193
New Zealand	5,974
Venezuela	4,929
Haiti	3,614
Australia	3,401
Italy	3,039
Bolivia	3,002
Guatemala	2,182
Siam	2,135
Dominican Republic	1,530
Poland and Danzig	1,260
Chile	1,033
Netherland West Indies	1,017
British Guiana	979
Egypt	979
Surinam	862
Nicaragua	854
Finland	656
Union of South Africa	607
British Malaya	450
British India	331
Other British West Indies	329
Ecuador	308
Jamaica	260
French West Indies	248
Norway	159
Rumania	114
Switzerland	104
French Guiana	71
Salvador	62
British East Africa	62
Denmark	52
Virgin Islands	50
Greece	36
Canary Islands	36
Algeria and Tunisia	34
Austria	30
Yugoslavia and Albania	24
Palestine	18
Costa Rica	17
Morocco	15
British Honduras	11

Parts exports spreading

The growing use of American equipment all over the world steadily broadens the demand for replacements, spare parts, and accessories. Exports of parts and accessories for aircraft went to 66 countries during the first half of the current year, as compared with 52 countries during the comparable period of 1931. In 1932 Japan replaced Canada as the leading market for these items, the former being the destination for $115,305 worth and the latter $64,496, followed in importance by China, Brazil, the Netherlands, Peru and Soviet Russia. British East Africa, Morocco and Palestine were among the interesting markets to which small shipments of U. S. parts and accessory exports were sent. The large number of countries to which parts and accessories were shipped indicates, even more than does the total value of the shipments, a trend favorable to the U. S. export trade in aeronautical products.

THE UNITED STATES OF AMERICA (PART FIVE)

The equipment of air forces

By
Edward P. Warner
Editor of AVIATION

THE preceding articles of this series have presented a complete survey of American combat planes and their development There remains one type that no Army or Navy or independent air force can get along without, even though it is a type that never goes near the front lines. Pursuit, attack, patrol, bombardment and observation pilots are all alike in one respect. At some time in their careers, they have all learned to fly. They all make their beginning on training machines.

It is 23 years since the first flying school was formally organized, but it is still possible to start a battle among experienced instructors over the best method of training and the best type of training ship. There has never been agreement upon the performances that training planes should possess and what their stability characteristics should be, or upon whether they should be made as nearly as possible like present service types in general arrangement and handling qualities or deliberately made to differ from them. While argument on all these points went on for four years after the War, both the Army and Navy peacefully continued to train pilots along the lines that had prevailed in 1918. The Army carried on with the Curtiss JN, and the Navy with N9 seaplanes, a maritime version of the Jenny with even more span and an even more elaborate wing truss—a beautiful box-kite structure, tied together with miles of unstreamlined wire.

When iron men flew wooden ships. Above: The Army's JN. Left: The Navy's N-9.

In Jenny's days

Looking down from the eminence of a dozen years' experience, the faithful Jenny still appears to have many of the qualities of a good training ship. The landing speed was about right; the flying qualities not at all bad. The outstanding defects were the maximum speed of around 78 m.p.h., a landing gear somewhat frail by modern training standards, and, most serious of all, a wooden fuselage structure which splintered on impact and was largely responsible for the almost invariable death of the occupant of the front cockpit in the event of a spin into the ground.

About 1922, the urge for better training planes began to translate itself into action. The first serious attempts to supersede the JN began when the Dayton-Wright Company, of which V. E. Clark was then chief engineer, produced its "Chummy" trainer, and the Huff-Daland Company finished an odd-looking craft with a Warren truss and the upper longerons suddenly projected up out of the fuselage at an angle to meet the upper rear wing spar in the center section, producing a framework over which an enclosure for the rear cockpit could be placed if desired. The side-by-side seating of the 80-hp. rotary-engined Dayton-Wright proved unsatisfactory for training, giving the pilot a biased point of view, a lack of self-confidence, and a persisting tendency to fly one wing low. Like the JN's that were in post-war use, both the Dayton-Wright and the Huff-Daland had the 180-hp. Hispano-Wright water-cooled engine, although both had taken account of the radial engine in the original design and the H-D was one of the first machines to be tested with the original nine-cylinder Lawrance, the progenitor of the Whirlwind. Both designers had undertaken to give the Army exactly what its training experts said they needed for training, and nothing else. There resulted two of the most unhandsome airplanes ever built for any purpose or in any country.

They did the work of training nicely, but they didn't do it quite well enough to justify scrapping a prodigious number of JN's and investing in wholly new equipment. Conviction on that point had to await formation of a new manufacturing company and its offer of a new type.

Consolidated trainers appear

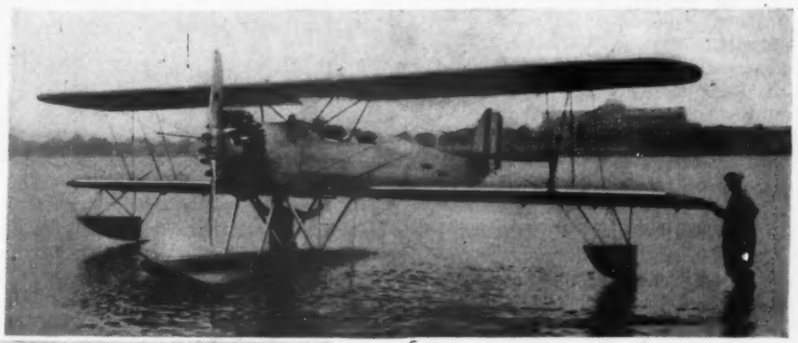
Major Reuben H. Fleet had been contracting officer at McCook Field in Dayton for several years after the War. He was particularly interested in problems of airplane procurement and of flight training, and in 1924 he resigned from the Army with the specific object of going out to build for the Air Service

an ideal training plane and to furnish it in quantity. The Dayton-Wright Company was liquidating its activities. Mr. Clark joined forces with Major Fleet, first in Rhode Island and then in Buffalo, and the Dayton-Wright trainer was taken as the foundation from which was developed the Consolidated PT-1, the Army's first post-war training plane. Like its predecessor, it carried the 180-hp. water-cooled Wright engine, developed from the Hispano. Like its predecessor, it was no thing of beauty, but it embodied a magnificent attention to detail. It showed the results of an effort to forecast everything that could ever happen to a training airplane in service, and to provide against them all. It did the work, and it did it without killing pilots.

The Consolidated design underwent only minor modifications to fit it for the Navy's service. The major change was the replacement of the water-cooled engine by a Whirlwind, in line with what was very shortly to become a universal Navy rule of air-cooled engines for all occasions. Floats of course supplanted landing gears on most of the Navy ships. The original idea was that the new type was to be only a stop-gap, a bridge from the N-9 to something designed solely and specifically to meet the Navy's special demands. Pursuant to that notion, a design competition, the first to be held under the new procurement law of 1926, was announced early in 1927. Seventeen companies offered designs in competition, and the prize and a trial order went to Curtiss, for the Fledgling.

The Fledgling did very nicely, but Pensacola recommended against a change in the basic type, and the Consolidated came back into favor. The Curtiss company, having sold 54 Fledglings to the Navy, built up about a hundred for the Curtiss Flying Service. Some of them are still flying.

The Consolidated company has produced, up to the present time, a total of well over 800 trainers for the Services. Well over 90 per cent of them follow closely the lines of the first machine that the company ever built, being primary trainers with engines of around 200 hp. and a speed of just over 100 m.p.h. The remainder divide between experiments at two extremes, an advanced training plane and a low-powered trainer. Both represent interesting development in official policy.



Built to take a beating from novices. Above: Pensacolan standby—the Consolidated NY-3. Left: Curtiss-built trainer—the Fledgling on floats. Below, left: Consolidated's latest—the YIPTII.

More power

If the history of American training plane development up to 1925 were surveyed, its most constant indication would be found in an almost steady increase in power. In 1916, a typical military training plane had 60 hp. During the first year of American participation in the War the figure stood at 90. By the time of the armistice it had climbed to 150. By 1924 it was up nearly to 200. It has stood in that general neighborhood ever since. At the same time, at least since 1926 the general swing in commercial flying schools and in the air forces of other countries was in the opposite direction. Light planes, of varying degrees of lightness, were going into service in the schools, and somewhere between 60 and 125 hp. was being made to serve by all the world except the American Army and Navy. Naturally the American Services felt called upon to experiment along similar lines, in the interest of economy if for no other reason, and a small number of light Kinner-engined Consolidated trainers, very closely akin to the commercial Fleet model, were ordered. They were tried and found, from the point of view of the Army's training organization at San Antonio, not heavy enough. The 200-hp. power-plant—changed from water-cooled to air-cooled about 1928—remains as the standard.

The other Consolidated venture, the Courier, fits into the story of the advanced training plane.

Advanced training

In the post-war itemization of the Army's airplane needs there were two types of trainers, primary and advanced. They were to differ principally in performance, and it was the idea, absorbed from French practice, that the first lessons should be taken on a plane of very limited capacities and very low landing speed, progressing thence to another which should serve as an intermediary stage between the primary trainer and the fighter or bomber. Something of that notion survived until 1925, but no advanced trainers were ever bought in any quantity by either service. The Vought VE-7, forerunner of the UO-1, came nearest to general acceptance for advanced training. About the time that the Army's and Navy's five-year plans became law, however, advanced training began to have a new significance. It began to imply direct indoctrination with service methods in planes that resembled the service equipment in everything except power, cost, and performance. Instead of being literally advanced trainers, they were elementary combat ships.

Trainers new and trainers old. Above, left: The Dayton-Wright TW-3 gave side-by-side seating a trial. Left: The Curtiss A-T4, with a 200-hp. Wright engine, was a low-powered pursuit ship. Above: The Douglass basic trainer is present standard for that work.

The first, and in fact very nearly the only, examples were the "advanced trainers" made from Curtiss and Boeing pursuit planes in 1927 by taking the 400-hp. D-12s out and putting 180-hp. water-cooled Wrights in. The maximum speed was dropped about 30 m.p.h.

The idea of using standard service types scaled down in performance proved less attractive in practice than in theory. The "feel" of a low-powered plane was inevitably different from that of a service type, and it could not reproduce the same maneuvers. Furthermore, the Air Corps and Naval Aviation are not organizations of specialists, and there are obvious dangers in beginning to specialize too early in the training process. The pilot who takes his advanced training with sole reference to pursuit flying may soon find himself transferred to a bombing squadron. Hence the Army's decision, some five years ago, to adopt a single type of "basic trainer" which would serve for advanced training in flying technique and might be used also for acquiring the first principles of pursuit, observation, attack, or bombardment, though in practice the type has been but little used in that way. The choice fell upon the Douglas observation plane as the proper foundation for a basic trainer. With some modifications, to permit of the installation of a miscellany of military equipment, and Wasp-engined, 166 Douglas BT's have been furnished to the Air Corps. Most of them are still in service at the Training Center in Texas. The first exemplification of the basic-trainer idea was really the Consolidated Courier, already mentioned, which was designed to mount fixed or flexible guns, camera, radio set, or a sight and a rack for dropping light bombs. It was limited in its capacity by its low power, only half that of the Douglas. In the very latest Consolidated, now undergoing service test, recourse has been had to the ingenious device of designing to take either a 200-hp. engine or one of 300 hp. or more, the wings having two alternative mountings and being shifted fore and aft for balance after engine changes.

In 1929 the Army set about a determined canvass of the training field. New designs were invited, and out of a considerable number received those submitted by Stearman, Verville, and Consolidated were chosen for small trial orders. None of them presented any very spectacular novelties of appearance. The final outcome was a decision to make no immediate radical change, but the new Consolidated primary-plus-basic trainer was chosen for service test, and 37 have been ordered. In any event, training purchases seem likely to be rather widely spaced over the next few years. The Navy's five-year program is completed, the Army's is nearing completion, and governmental economy is in high favor. The rate of training piloting personnel is likely, unless there be a radical reversal of policy, to fall off considerably. From the fiscal years 1927 to 1929, inclusive, the Army bought 290 primary trainers and the Navy 259. In the fiscal years 1930 and 1931 the total figures were 28 for the Army and 52 for the Navy, and 46 of the total were Consolidated. Neither Service plans to buy any this year.

Training trends

It is easy to summarize general trends in training-plane design, for they have shown but little change in seven years. The absence of striking novelty in the machines that came off best in the recent Army competition was symbolic. Improvement is in detail, and especially in the details that affect ruggedness and ease of maintenance, though there has been some "cleaning up" and improvement of performance. Progress along those lines will continue, but there is no reason to doubt that the typical American trainer will continue to be an externally-braced biplane, with a 200-hp. air-cooled engine, a top speed of around 110 m.p.h., designed for the utmost possible safety for both occupants in case if a crash, and with cockpit arrangements and general control and flying qualities as much as possible like those of a standard military observation plane. As yet, at least, there is no sign that the all-conquering dural-monocoque monoplane is to extend its conquests in the training field.

A series of articles that purports to tell the complete story of American air force equipment ought not to be wound up without some mention of the non-combat types, other than training, of which small purchases are made from time to time. Most specialized in design requirements are the ambulance planes, but little work has been done along that particular line in America. The French Army has attached a great deal of importance to the ambulance plane for colonial service, and a number of ships of several different makes have been bought. In the United States, on the other hand, there have been only three or four experimental purchases spread over the last ten years. The usual tendency has been to adapt a transport or a bomber for carrying wounded when the need arose, or even to use an observation plane as Lieut. Schilt of the Marine Corps did on the occasion when he made seventeen successive flights with a Vought Corsair into and out of the main street of a Nicaraguan village to pick up the victims of a battle and take them back to the base hospital—an exploit that brought a well-deserved award of the Congressional Medal of Honor. If ambulance planes are recognized as a special type only a few of them can be purchased at best, and those few may not be where they are wanted when the critical time arrives. Nevertheless it is surprising that so little work has been done on the development of special designs, independent of any other type from the ground up, with the idea that a small number might be built to be distributed at particularly strategic points,

and with Marine Expeditionary Forces.

More important in terms of gross volume of military purchases, though making less specialized demand upon the designer, is the transport or (as the Air Corps calls it) the "cargo" plane. The military need for transports for mechanics and supplies, in order that a squadron might go into the field as a unit and move about in complete independence of railroads and trucks, was realized immediately after the War, and the fuselage of the original Martin bomber was modified to make it into a ten-passenger transport as early as 1919. The first purchases in quantity, however, went to the Douglas Company, which brought out the Liberty-engined C-1, with six passenger seats, in 1923. It had an exceptionally high performance for its power and weight, thanks largely to the decision that refinements of passenger convenience could be ignored in a military ship and that, in particular, headroom could be ignored.

Thereafter, transport design took a new tack. The Army had had to lead the way, for the Army's need was realized before any commercial transports existed. By 1926, however, it was possible to take advantage of commercial development. The British Royal Air Force has continued up to the present time to make it a practice to issue specifications for military transports quite independent of any commercial development, and indeed the latest and most promising of R.A.F. transports comes from a factory that has never built a commercial airplane, but the American Army and Navy have saved money by following the commercial lead. Cabin arrangements and equipment of course depart from the commercial form, and construction is modified in detail, but in essential principle most of the cargo purchases of the last five years (they have totalled 114 for the Army and 22 for the Navy) have been standard Fords, Fokkers, and Sikorskys. In addition to these standard transport types the Air Corps has been experimenting with super-high-speed ships of smaller capacity for official transport and emergency use. A dozen Lockheeds, Consolidated Fleetsters, and Northrops have been bought.

A few odds and ends of "utility" and photographic planes complete the tale. Those, like most of the recent transport and cargo ships, have sprung very directly from commercial origins. Of the orders, such as they have been, the old Fairchild Company received the largest share.

Transportation for healthy soldiers and for wounded ones. Top: Douglas built the first Army transport plane to be ordered in bulk about 1924. Center: Cox-Klemin's 1922 ambulance plane, with stretcher support visible through the window. Above: A single-engined Fokker plays a large part in the cargo class in 1932.

IN bringing to a close the section of this series that has dealt with the development and the present status of American equipment, we take occasion to make collective acknowledgement to all those who have helped in preparing them. To guard as far as possible against error or important omission, advance copies of each article have been forwarded to those, in the services and in the industry, who have been most actively concerned with the evolution of the particular type to which that particular section of the manuscript related. Many of them have taken the time and trouble to read the articles both carefully and critically, and their comments have permitted us completely to redraft, and very greatly to improve, the manuscripts before publication.

Special acknowledgment is of course due to the Chiefs of the Air Corps and of the Bureau of Aeronautics, and to the personnel of their offices. Whatever authority or value as a work of reference the military equipment series may possess is due largely to their willingness to supply missing figures, to have the records checked for the accuracy of the statements that had been made, and to help in a dozen other ways. The individuals who have cooperated are so numerous that we cannot even give a complete listing of their names, to say nothing of itemizing the forms that their assistance has taken. Prominent among them have been: Maj. Gen. M. M. Patrick, former Chief of Air Corps; Rear Adm. J. M. Reeves, former Commander Aircraft Squadrons, Battle Fleet; Brig. Gen. H. C. Pratt, Chief of Material Division, Air Corps; Rear Adm. E. S. Land; Maj. Leslie MacDill; Maj. C. W. Howard; Maj. G. E. Brower; Maj. H. A. Dargue; Maj. F. L. Martin; Maj. Ralph Royce; Lieut. Comdr. Rico Botta; Lieut. Comdr. A. C. Davis; Lieut. Comdr. H. M. Mullinix; Lieut. Comdr. H. C. Wick; Maj. T. G. Lanphier; Dr. George W. Lewis; Capt. G. C. Westervelt of North American Aviation; Capt. H. C. Richardson of Great Lakes; C. N. Monteith of Boeing; Messrs. T. P. Wright and Burdette S. Wright and Comdr. Bruce G. Leighton of Curtiss-Wright; Comdr. E. E. Wilson and Messrs. C. J. McCarthy and E. W. Dichman of Vought; L. C. Milburn and B. C. Boulton of the Glenn L. Martin Company; Maj. R. H. Fleet of Consolidated; Ralph S. Damon of Keystone; Temple N. Joyce of B/J; B. D. Thomas of Thomas-Morse; C. B. Squier of Lockheed; A. E. Raymond of Douglas; Charles Ward Hall of Hall Aluminum; Frank H. Russell and T. H. Huff.

THE SIXTH ARTICLE OF A SERIES ON MAINTENANCE

Maintaining aircraft in the Southwest

A study of American Airway's maintenance base at Dallas

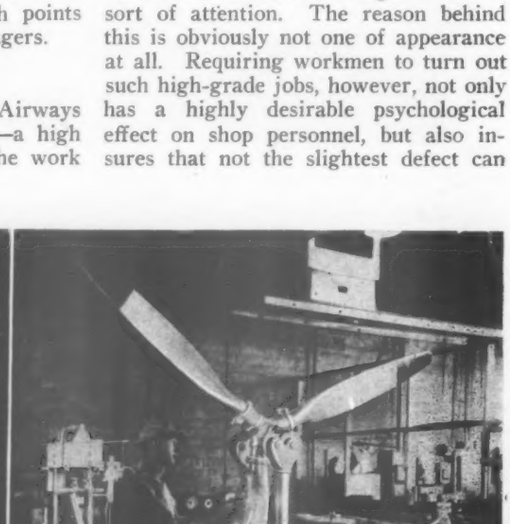
WITH the abandonment of its former divisional organization scheme, American Airways has recently consolidated practically all its operating activities at its new headquarters on Lambert Field, St. Louis. The principal executive offices remain in New York, but practically everything else has been moved to St. Louis. Because of the unusually large territory served by this line, however, it has not been considered expedient to attempt to concentrate all airplane and engine maintenance at one point. The old Southern division shops at Dallas have been retained, and the former Universal division's maintenance base at St. Louis has been expanded to take care of planes and engines flying in the eastern part of the country. All ships flying on the New York-Boston, New York-Cleveland, Cleveland-St. Louis, Cincinnati-Dallas, St. Louis-Chicago, and St. Louis-New Orleans routes are handled at St. Louis. All other equipment used between Atlanta and the West Coast, and Dallas and Brownsville, including intermediate points, passes through the Dallas shops for maintenance and overhaul.

Mr. H. B. Taylor, formerly in charge of maintenance on the Southern division, has been transferred to St. Louis as general superintendent of maintenance for the entire line. Mr. Richard Ingalls, who was in charge of maintenance on the old Colonial division at Newark, is in charge of the St. Louis plant, and Mr. William B. Click, former engine overhaul foreman at Dallas, now is responsible for all work at that point. The servicing of planes and engines at the terminal and intermediate stations (Newark, Cleveland, Chicago, New Orleans and Los Angeles) comes under the general supervision of Mr. Taylor, although the detailed administration of personnel and material at such points falls to the local terminal managers.

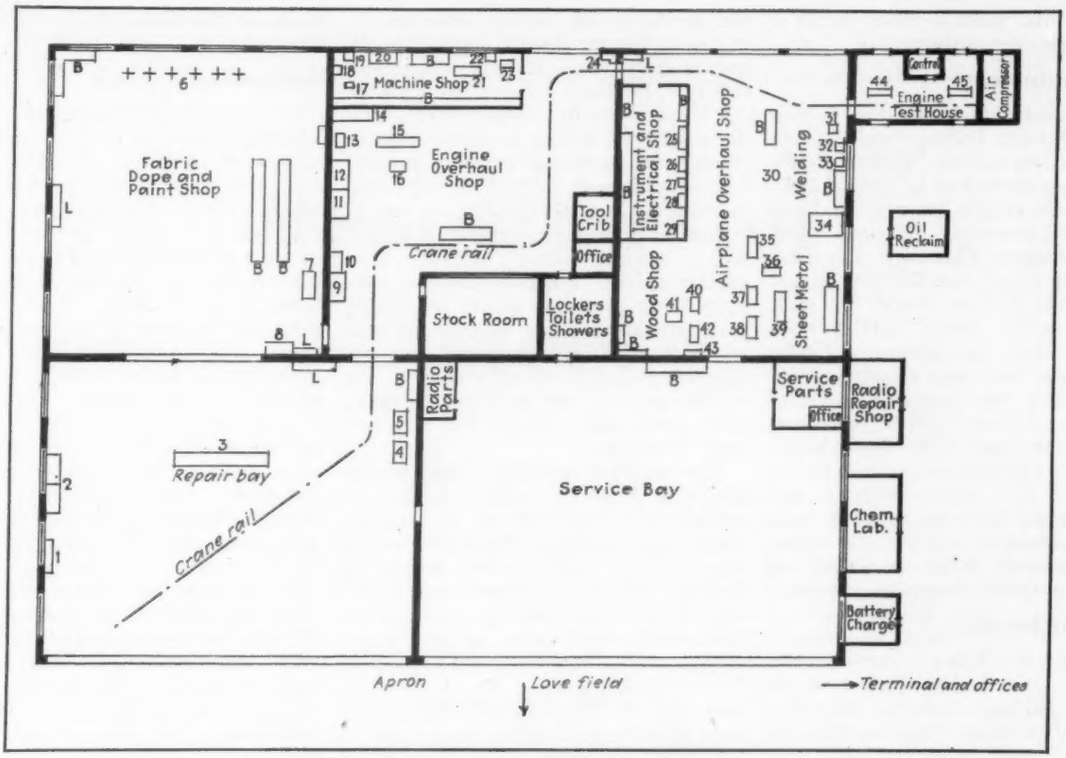
Careful workmanship

The Dallas base of American Airways has long had—and deservedly—a high reputation for the quality of the work turned out. Very few shops in the country, for example, turn out engines cleaned, polished and burnished to such a degree as those coming through Dallas. The outward appearance of overhauled engines is excellent (comparing favorably with new ones from the manufacturer's production line) but the meticulous care which is given them is most evident when one inspects the individual parts before they are reassembled. Minute examination of a piston, for example, will disclose not one scrap of carbon, inside or out. Connecting rods are polished down to the smallest fillet with fine crocus cloth until they are as smooth and free from discoloration as the day they came from final factory inspection. Cases, gears, valves and crankshafts are given similar sort of attention. The reason behind this is obviously not one of appearance at all. Requiring workmen to turn out such high-grade jobs, however, not only has a highly desirable psychological effect on shop personnel, but also insures that not the slightest defect can

Servicing an F-10 at Dallas. Note details of portable working platform.



The propeller overhaul at Dallas.



Shop lay-out, American Airways, Dallas

Key: B. Benches; L. Lockers; 1. Scales; 2. Racks; 3. Wing turning apparatus; 4-5. Racks; 6. Wing trees; 7. Sewing machine; 8. Storage bin; 9. Bake oven; 10. Paint hood; 11. Washing vat—steel parts; 12. Washing vat—aluminum parts; 13. Grinder; 14. Propeller etching vat; 15. Propeller table and protractor; 16. Hydraulic press; 17. Welding torch; 18. Tool grinder; 19. Valve grinder; 20. Lathe; 21. Milling machine; 22. Drill press; 23. Cylinder grinder; 24. Spray wash rack; 25. Lathe; 26. Magneto tester; 27. Grinder; 28. Arbor press; 29. Carburetor tester; 30. welding equipment; 31. Drill press; 32. Grinder; 33. Nibbler; 34. Heat treating furnace; 35. Metal brake; 36. Squaring shear; 37. Circular cutter; 38. Roll former; 39. Sheet metal bench; 40. Band saw; 41. Circular saw; 42. Planer; 43. Jointer.

possibly be overlooked. A crack in a connecting rod may be hidden below the edge of an almost insignificant stain left on the metal by cleaning compounds, but when a man must work carefully to remove the stain, the incipient crack must come to light. It is difficult to evaluate the exact benefit of insistence upon work of this character, but any additional cost involved may be written off as a form of insurance against an engine failure which might ruin the reputation of the shop, if not of the line.

Believing that so-called production line methods on engines often militate against the quality of the work, the Dallas shops retain the crew overhaul idea. Each unit consists of an expert mechanic and a helper. Engines coming in for overhaul are assigned to a crew which carries out the entire procedure from teardown to reassembly, and is entirely responsible for the ultimate behavior of the engines. It is believed that with the responsibility for the proper functioning of an engine resting squarely on the shoulders of the crew that overhauled it, the men themselves take a much more personal interest in the work they are doing. It is not unusual at Dallas to see an engine overhaul crew checking carefully the performance record of their particular engines on the test stand. It is quite possible that any slight non-uniformity between engines due to variations in the work of individual overhaul crews, is more than offset by this factor of personal pride and rivalry.

In this connection an interesting situation exists in that the St. Louis shops of the same company are organized on a production line basis where an engine passes progressively through the shops from teardown to run-in, passing through the hands of mechanics who do nothing but one special job on each engine. American Airways thus has within its own organization a means of making an exact comparison of the two methods.

Engine test data plotted

In running-in engines after overhaul, it is common practice to check the performance of the engine at several points in the speed range, and if the performance seems satisfactory at these points the engine is approved for service. The test data under this system are usually taken and kept in tabulated form on engine test log sheets. At the Dallas shops, however, a complete set of curves is plotted for each engine at each run-in period on a sheet on which are printed the standard performance curves for the particular engine involved. A glance at the completed curves indicates at once any variation or trend away from its standard characteristics. Brake horsepower, specified fuel consumption, and gross fuel consumption at speeds ranging from 1,000 to 2,000 r.p.m. are plotted on the chart. The curves are then filed as a part of the permanent history of each engine.

The majority of the engines now handled through the Dallas shops are Pratt & Whitney Wasps and Hornets. The present inventory includes 85 of the former and five of the latter. Fifteen Wright engines in use on the Stearman mail ships are also taken care of at Dallas. All engines are sent to the shop for overhaul between 300 and 350 flying-hours. It takes about six days for any one engine to go through the shop, and each overhaul represents about 125 man-hours of labor, including tests. Under present conditions about twenty engines a month are being handled at Dallas, but the estimated maximum

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capacity of the plant is close to 50 a month, or two per working day.

Flying equipment

The airplane equipment, which passes regularly through Dallas, consists principally of Wasp-powered Fokker F-10's which are supplemented by several Fokker Super Universals (in reserve), and five Hornet-powered American Airplane & Engine Company Pilgrims. Night-flying mail is handled with Stearmans, of which three Model CB with five and seven Model 4MC-1 with Wirlwinds are in service. Under ordinary conditions each airplane comes into the shop for complete overhaul about once a year, which represents between 1,000 and 1,800 flying-hours. The shop is well equipped to handle the overhaul of the largest ships in use. Recently, under some pressure two completely overhauled F-10's were turned out in somewhat under six weeks, but the average time is somewhat greater.

The plant lay-out

The plant at Dallas is conveniently located on Love Field, adjacent to the American Airways terminal and office building. It is housed in a modern concrete, brick and steel building, adequately equipped and laid out for the purpose. The accompanying drawing shows clearly the floor plan and the principal items of equipment. Taking into account the most efficient relationship of departments, an industrial engineer might criticize the layout on account of the separation of the two aircraft overhaul shops. The reason behind this has some historical interest. The shops were originally built by the old Southern Air Fast Express System before it was acquired by American Airways. The original intention was to operate a combination bus and airline, and the floor space now assigned to the airplane overhaul shop was intended as an overhaul shop for the buses, which accounts for the three large doors in the north wall. Airplane overhaul operation was to be confined to the present fabric, dope and paint shop, and to the two hangar portions of the building. Under this arrangement the engine shop was centrally located, so that it would receive and deliver engines from both the airplanes and buses for overhaul. With the disappearance of the latter from the picture, and with a steadily increasing demand for space for airplane work, the bus overhaul department was fitted up with its present equipment for handling wood, sheet metal, welding, and electrical repairs on airplanes. This slight novelty in layout, however, has apparently had little if any real effect on the overall efficiency of the plant.

Routine line servicing operations (before flight, and the regular 25, 50 and 100-hour checks) are carried out either in the servicing hangar, as shown on the accompanying layout drawing, or in a small hangar about a hundred yards east of the terminal station. As a general rule, the large three-engined planes are handled in the main hangar, and the auxiliary building is devoted to the storage and servicing of the Pilgrims. The operations in each of the servicing hangars are conducted under the supervision of separate servicing foremen, each reporting directly to the shop superintendent. For administrative purposes the overhaul shops are subdivided with separate foremen over the aircraft overhaul; the engine overhaul, and the instrument and electrical overhaul. As in the case of the servicing foremen, these men report directly to the base superintendent.

The airplane servicing departments are well fitted out with a variety of equipment to facilitate the handling of planes and engines. Ships are moved into the hangar and around the aprons behind caterpillar tractors coupled to special tail wheel dollies. A number of light and sturdy steel platforms on casters are on hand to assist mechanics in servicing engines. For a complete servicing on three-engined airplanes, a very effective portable working platform has been developed. The stand is in two sections, which when pushed around the nose of a three-engined machine make a firm walkway surrounding all engines of the airplane. Electric and compressed air outlets are built into the platform, and each section has a workbench with vises, tool drawers, etc., fastened rigidly to it. Large swiveling casters make it possible to move it easily on the concrete floor. Whenever it is necessary to remove an engine the plane is run into the repair base under the hoist rail, and the engine supported and lifted out by means of a chain fall and suitable sling. As indicated on the drawing, the rail passes through both the airplane repair shop and the engine shop, so that the heavy material may easily be transferred back and forth as required.

Reclamation of oils

The practice of reclamation of engine lubricating oil has become fairly common on the airlines. The Dallas plant not only reclaims the lubricating oil, but also recovers a high percentage of the light petroleum spirits used for washing down engine and airplane parts. The engine oil reclaimer, quite different from the outfits ordinarily supplied by commercial reclaiming companies, was designed and built by Mr. H. B. Taylor during his superintendence of the Southern division. The reclamation process is very simple. It consists merely of allowing the old oil to settle in a sediment tank under controlled temperature, and subsequent filtering through an ordinary refinery-type paraffine press. A small amount of Fuller's earth is sometimes added to the settling vat to clear up the color of the oil. The reclaiming plant has a capacity of 12 bl. of oil per 24 hours. The product is carefully and continuously checked in an adjacent chemical laboratory, and the average run is found to correspond very closely to new oil in physical properties.

The cleaning compound reclamation is purely a distillation process. A small still and condenser plant has been set up in a vacant lot well away from any of the other buildings. Drainage from the cleaning booths is collected in drums and taken out to the still as it accumulates. The operation of this process shows a very nice saving. Approximately 90 per cent of the cleaning compound is recovered in its original condition. The sludge and heavy ends remaining in the still are drained off and serve as fuel to heat the still. The process is thus more or less self-supporting, virtually the only cost being the labor involved in transporting the drum to and from the still house.

Replacement engines in servicing

BECAUSE of the interchangeability of sub-assemblies on all Jacobs engines, a servicing plan has been developed whereby completely assembled replacement units have been placed with distributors at convenient locations, so that if failure or unusual wear occurs in any part of an engine at any time, the owner may be able to replace the entire unit on short notice. The unit containing the defective part is turned back to the distributor who will, when necessary, ship it in to the factory for repair.

Over and above the parts replacement plan outlined the Jacobs servicing plan includes complete overhaul by the factory at a flat rate. The price includes all necessary parts, materials and labor, but does not include transportation to and from the factory, or charges for removing or re-installing the engine in the airplane. Operators in remote localities, where considerable amount of time would be lost in the transportation of engines before and after overhaul, may make arrangements with the local distributor for the temporary loan of an engine at a nominal charge.

AVIATION
November, 1932

S.A.E. discussion coincides with introduction on racing planes

Propellers of steel

THE use of steel propeller blades was a subject of great practical interest during the recent National Air Races. For the first time, they made their appearance on racing planes in competition with the aluminum-alloy blades which had hitherto been standard. It was a very strategic time at which to present a discussion of the engineering problems of the steel blade, and the Society of Automotive Engineers had a very complete paper on that subject from James H. McKee, chief engineer of the Pittsburgh Screw & Bolt Corporation, makers of the blades used on Doolittle's Gee Bee and some of the other competing ships.

The Pittsburgh company's blades derive directly from the work started by Thomas A. Dicks in 1920, and depend on the welding together of two sheets along the leading and the trailing edges. An alternative method, fabricating the blades from a seamless tapering tube machine-wedged and die-formed, has been used by the Hamilton Standard company.

Stainless steel in the offing

A propeller blade is so highly stressed and subject to so much vibration and such abnormal fluctuations and concentrations of stress, especially along the leading and trailing edges, that any welds at those points must be of extraordinarily high quality. The weld depends on the material, and the Pittsburgh Screw & Bolt Company's experience has indicated the use of chrome-vanadium or chrome-molybdenum steel. Mr. McKee suggested, however, that the use of stainless steel might be just around the corner. The chrome-molybdenum steel now used is made with specifications essentially like the S.A.E.'s X4130 for fuselage tubing, but with more rigid tolerances. The amount of sulphur and phosphorus allowed are less than half what the Army sanctions for fuselage work, and the limits on the alloying elements are much more closely controlled than in general aeronautical practice. The welding is done by gas, with the two plates that form the blade held in a jig which prevents any distortion or change of pitch during the welding process. The success of this positive restraint against distortion, both during assembly and while being heat treated, is one of the most remarkable features of the work.

Heat treated after welding

After welding, Mr. McKee explained, the blades are normalized by heating to 1700 deg. Fahrenheit, and then reheated to 1650 deg. and oil-quenched to produce the maximum physical properties. Each blade has to be confined in another jig while quenching to prevent twisting or bending, and immediately after removal from the liquid it is reheated to 1000 deg. F. to complete the treatment. The final result is a yield point of about 130,000 lb. per sq.in. and a maximum reduction of cross-sectional area of material prior to rupture, when tested under tension, of about 60 per cent. The Army specifications for chrome-molybdenum tubing, with an approximately similar heat treatment, produce about the same yield point but with a normal expectation of a considerably smaller elongation or reduction of area before failure.

The blade forms are so chosen that the centers of gravity of all the sections should lie on a straight line to the blade axis. Balancing has to be performed with very great care, both around the axis of rotation of the propeller and around the axis of the blade itself, and each blade is checked against a master or template blade to secure absolute interchangeability.

The sheets used are tapered, not into a simple wedge form but along a curve of thickness calculated for constant stress throughout the blade.

The author of the paper, speaking frankly as a partisan of the steel propeller blade, maintained that it showed a greater rigidity than could be obtained with an aluminum-alloy blade and a saving in weight of as much as 60 lb. for a complete propeller for a 550-hp. engine. The weight reduction would be particularly important on a controllable-pitch propeller, since the steel could be used at much higher bearing pressures than the aluminum alloy and therefore allowed of a smaller blade shank and a lighter drive mechanism for rotating the blade. In a general summary of the merits of the type, Mr. McKee made the following claims for the steel blade:

(1) Strength and fatigue endurance superior to that of any other present type of blade.

(2) Great rigidity and ability to maintain their pitch form under severe service.

(3) Smooth and quiet operation resulting from resistance to torsional vibration.

(4) Minimum weight, due to use of high-strength steel alloys and placing of material where it is most needed in the blade design.

(5) High erosion resistance enables steel blades to be built with very thin edges without danger of chipping action from sand and water.

(6) Blades can easily be balanced to give perfect balance through a wide angle change.

Noise reduction accomplished

The Pittsburgh Screw & Bolt Company has given particular attention to the reduction of noise and the possible increase of efficiency by applying boundary-layer control to propeller blades. The device of taking the exhaust gases from the engine into the propeller hubs, and out through the blades to escape through slots near the leading edge of the backs of the blades, was reported to have reduced the noise by 50 per cent and to have increased the efficiency materially. The mechanical difficulties resulting from the extremely high temperature of the gases were, however, acute. It is in concession to those troubles that the exhaust gas method has been abandoned, at least for the time being, in favor of passage of air from a scoop on the front of the propeller hub out through the blades to the slots. The silencing action has proved almost as marked as with the exhaust gas, and the experiment goes on.

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

How will you have your economy?

IN BARELY six weeks another session of Congress will be upon us, and another budget will be presented. Within three months thereafter, for this is a short session of Congress and ends by law on March 4, the budget will have been taken to pieces and reassembled and the appropriation bills will have been enacted. Their final form will have vital significance for the aircraft industry. It is not too much to say that the whole fate of American aviation over the next couple of years will depend upon the action being taken by the Bureau of the Budget now, and that subsequently taken by the Appropriation Committees and the two houses of Congress.

The most alarming thing that aviation may have to meet in the next session—let us face it squarely—is the display of hostility to the air mail in the sacred name of economy. The Senatorial cabal that tried to cut the appropriation in half at the last minute in the last session is likely to be back in force, and they may have collected some reinforcements. No less a postal authority than Representative Mead, chairman of the House Post Office Committee, has formally proclaimed that aviation is escaping its due share of postal economy.

Mr. Mead's views are important enough, because of the position that he holds, to be examined in detail. He says that "There have been no reductions in the 'subsidies' nor in the leases, where the strain on the treasury has been the greatest." He speaks of the department as "maintaining the regular payment on air mail contracts." He says that: "The airlines have benefited by reduced costs. Why can't the government get some benefits from that condition?"

We have no way of knowing how deeply Mr. Mead's special committee of inquiry may have pressed its investigation. We do know that the quotations just presented show the committee's chairman to have been curiously misled. Approximately two-thirds of the total expenditures of the Post Office Department on the so-called contract air-mail services, foreign and domestic, are made under route certificates which leave the rates open to readjustment at will by the Postmaster General. At the approximate beginning of the period of cost reduction to which Mr. Mead refers, in the spring of 1930, the average rate of payment for the carriage of mail on the domestic airlines was about 98 cents per mile flown. In the summer of 1931, at about the time the pressure for governmental economy was beginning to become acute, it had fallen to an average of 70 cents a mile, in spite of the fact that mail loads were steadily increasing and that larger, faster, and more expensive equipment was coming into service. In the summer of 1932, the average rate of payment had dropped off another 20 per cent, to 55 cents a mile. The rate of payment by the government per unit of service rendered by the air mail carriers has gone off more than 40 per cent in the last 2½ years, and we very much doubt if Mr. Mead or anyone else can find any index of costs or of commodity prices which shows as large a relative reduction as that during the period of the depression.

If Mr. Mead, or Senators Glass and McKellar and other opponents of the air mail service, will approach the statistical record of its performance with an open mind, it is possible that they may still oppose its extension. They may even continue to advocate restriction or abandonment of the service, but in all fairness there is one thing that they cannot do. They cannot possibly refuse to concede that very substantial and steady progress has been made over the past five years, and that the air mail is doing more work than ever before, doing it better, and doing it with constantly decreasing cost to the government.

We are sincerely hopeful that it will be possible to overcome a large proportion of the Congressional opposition to the air mail service by candid presentation of the facts and explanation of what has been done and what is planned for the future.

In some cases, however, prejudice may be so deep-seated that it cannot be overcome at first hand by any showing of performance. It will be necessary to rely again, as air transport had to rely last June, upon the court of last resort—the people from whom the members of Congress draw the warrant for their own continued presence in Washington.

There was a vast deal of talk last spring of reductions to be made in the air mail appropriation. The budget had been reasonably generous with the service, but some of the gentlemen just mentioned made persistent attacks on the appropriation, and demanded its reduction by a third or even a half. They got nowhere, and the reason they got nowhere was that it became plain that the American people wanted the air mail service to continue. The Congressmen heard from their

constituents, individually and through civic organizations, and if any attempt is made to cut the air mail appropriation arbitrarily or to such an extent that the service rendered would have to be reduced, the Congressmen will hear from their constituents again,—always provided that the constituents really know what is going on. It is the business of every individual with any interest in aviation to tell his neighbors and the responsible leaders of his community of what has been done, and of the disastrously destructive and wasteful results that would attend any drastic cut in the appropriation for the next fiscal year. If the voters are sufficiently reminded of the extent to which they have learned to depend upon the air mail service, and if they are sufficiently well informed upon its steady progress towards self-support, and upon the record of cost reduction and of improved performance as we have set it forth earlier in this editorial, we have no fear of the action of their representatives in Washington.

Replacement by program

THERE are three ways in which a transport enterprise may be run. New equipment may be purchased and the old replaced in accordance with a definite schedule,—or it may be replaced during financial booms,—or it may never be replaced at all. This is a generalization. It applies equally well to airlines and motor bus services and ferry boats.

Each of the three methods has some attractions. There is a good deal of logic at first sight in a policy of replacing only when money is easy and investors are fairly forcing their savings upon the market. The alternative of never spending any money for replacement at all is even more enticing, especially in hard times. It is likely to be supported by the pride of the maintenance force, who will aggressively declare that no airplane (or street car, or locomotive, as the case may be) under their care ever wears out. Within the past year, the writer of this editorial was assured by the superintendent of maintenance on an American airline that five-year-old airplanes were just as good as new, and that there was no reason in the world why they should not be kept going indefinitely. "Every time they come into the shop for overhaul" he said, "we send them out as new ships, ready to start another five years."

To talk of a total abandonment of replacement may seem ridiculous, yet that is precisely the basis upon which various surface transport enterprises appear to operate. The street railways of America carry in normal times an almost constant total of fifteen billion passengers a year, yet during the past five years their annual purchases of new equipment have averaged only 0.7 per cent of the number of cars in service. Even before the War the mean replacement rate was less than 4 per cent, corresponding to a 25-year life. The companies' repair shops take the old cars, and rebuild and rebuild and rebuild. The airlines might conceivably follow the same policy. There is very little danger that air transport ships will ever assume as debilitated and dejected an air as has long characterized a great many street cars and railroad cars, or such as even the comparatively new motor bus equipment is beginning to show in some instances, but there is a very real possibility that the airlines may make the same sort of mistake in a lesser degree unless they guard against it by adopting a very definite replacement policy and sticking to it faithfully.

The choice of replacement systems is likely to depend very largely on the accounting method used. The temptation to postpone, and to keep on postponing indefinitely, will always be strong if the purchase of new airplanes is considered as something that happens all at once and requires the sudden expenditure of a substantial lump sum out of capital. It is in fact an invariable economic law that replacement policy is the offspring of depreciation accounting policy, and that the characteristics of the parent determine those of the child. It is almost inevitable that equipment will be run too long if depreciation appears only as an item on the adjustment of capital surplus on the balance sheet, or if the rate at which depreciation should accrue is determined by someone's "hunch" or by some traditional rule, rather than by a careful analysis of all the economic consequences of replacement at various periods.

The normal practice in every instance ought to be to charge depreciation on a generous scale directly against each year's income, and to consider that the amounts so charged are absolutely ear-marked to a sinking fund for purchasing new planes and engines in due course. In some cases, however, no such reserve has been built up, or if one has been created it is not of adequate size. It may be necessary in those instances, if new planes are to be bought, to take the money out of the cash in the capital account which has so far been considered as undistributed surplus income, ultimately to be available to the stockholders. Any such course is admittedly distasteful, and if it is to be followed it must be very fully justified. Justification can be supplied only by thoroughgoing analysis of what it will cost to operate the existing equipment through the next two or three years, including maintenance, and of what it would cost to operate new planes, of more modern design and higher efficiency, purchased at this time. A comparison of the figures so obtained ought to indicate the path to be followed so plainly that there will be no room left for argument. We believe that anyone who will make such an analysis will be quick to conclude that all equipment purchased in 1928 or earlier (and that means 15 per

cent of the present equipment of American airlines) should be replaced within the next ten months, that all 1929 equipment (which is another 35 per cent of the present stock) should be supplanted by the end of 1933, and that all that built in 1930 or 1931 should go out of service by the early spring of 1935.

We are convinced, furthermore, that such an analysis will be an object lesson to those who may never have undertaken anything of the sort in the past, and that it will bring them to a firm resolve to build up depreciation reserves henceforth at a constant rate and to plan replacement of all equipment on a basis of not more than a four-year life. Only through such a policy, generally adhered to, shall we be in a position to exploit aeronautical engineering progress.

Do we want a show?

A NATIONAL AIRCRAFT SHOW, wherever it may be held, is a delightful event. Old friends meet for the only time during the year. There is a steady flow of press releases announcing the sales that have been made, and the plans for quantity production that are being made. The air is suffused with a fresh glow of optimism, *but,*—let us suppose that we are to have another show next spring as for four years past. When the tumult and the shouting die, will it have been worth what it cost?

The 1932 show gave but little encouragement for next year. It was run under the best possible auspices. It had the most experienced management, and although there was some scepticism about its value in the industry most of the manufacturers co-operated to the limit. Yet two-thirds of the exhibits were essentially the same as in 1931, and a considerable number were absolutely identical with those of the previous year, even to the details of stand decorations.

If we hold a show next year we shall have very much the same story to tell. In spite of the best that may be hoped for from business improvement in the meantime, there will not, unless our judgment is much at fault, be enough new spring models coming out to justify getting the industry together to look at them. Under present conditions, and until the aggregate sales of non-military aircraft in the United States again pick up to at least 5,000 ships a year, one show every two years is quite enough. If the Chamber of Commerce committee which has the matter in hand will end all suspense by taking a definite position and making a definite announcement that no show will be sanctioned for next year we believe that most of the industry will heave a sigh of relief.

There has been some quibbling over laying the show aside for a year, or adopting a straight biennial policy for the future, and some suggestion that it would be a confession of defeat and an admission that the industry was losing strength. There is no occasion for any such feeling. The shows of 1929 and 1930 were organized to meet a situation that no longer exists. One of their major purposes, if not the most important one of all, was to show the people of various metropolitan districts what a modern commercial airplane looks like and to present them with the evidence of their own eyes that there had been a big change since the War. In 1933, nothing of that sort is needed. The work has been done and the lesson learned. Aircraft shows must hence be considered in terms of their direct return to the industry, and not of the miscellaneous attendance that they can drag in, nor of the amount of newspaper mention that they collect. It is even possible that a national show next year might be made self-supporting, if coupled with a sufficient variety of popular attractions and skillfully publicized, but it could not possibly be the direct source of enough sales of aircraft or accessories to compensate the participating exhibitors for their outlay of money and energy. Airplane manufacturers, it is well to remember,—and sometimes very necessary to remind ourselves,—are not in the business of producing popular entertainment.

If a show is held, we shall be there. We shall enjoy it to the full, and we shall give it the fullest possible report in AVIATION, but so long as the question of holding a show remains open for discussion we are, unless we change our minds with changing conditions and announce the fact in these columns, ag'in' it. We are against it if it be held in a hangar or a hall. We are still more firmly against the proposal, frequently urged a year ago, that the show become ambulatory and go cruising about the country on the wing. We firmly and confidently believe that there are better and cheaper ways than that of keeping the men of the industry informed upon the industry's products, and of reaching real potential buyers with the information that they need.

THE editor of AVIATION *is about to leave for Europe to attend the Paris Salon, the first great European aeronautical exhibition since 1930, and report on current design practice and developments from the American point of view. Incidentally, he expects to look into a variety of other matters. Readers are invited to give him the benefit of their suggestions about those phases of European practice, in design, construction, or operation, which are particularly interesting to the American industry and which might be made the subject of special articles. Mail can be addressed to Mr. Warner at the London office of* AVIATION, *Aldwych House, Aldwych, London, W. C. 2.*

STATISTICS OF THE MONTH

Supplementing the statistical issue of AVIATION, *March, 1932. Page numbers refer to that issue*

PRODUCTION AND LICENSING
(Page 118)

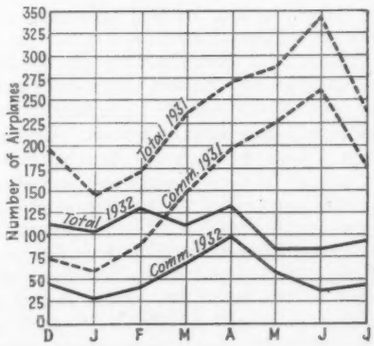
Airplane and Engine Production
Commercial and Military
(First half year)

	1931		1932	
Planes.....	1,453	$10,682,082	641	$6,623,861
Engines.....	2,329	7,909,820	1,024	5,017,992
Total.....	....	18,591,911	....	11,641,853

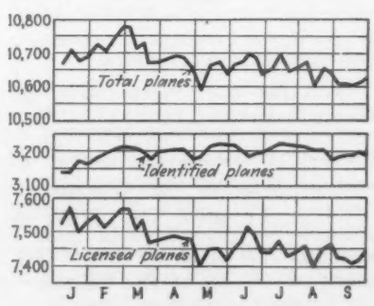
THE depression-resistant qualities of air transport do not characterize airplane manufacture, which in the spring of this year pursued a course quite contrary to the usual seasonal rise. Total production, including military, which in April was exactly half that of the previous year, by June had dropped to only one-fourth the 1931 figure.

In value of output 1932 got off to a fine start with production of aircraft and engines for aircraft some eighteen per cent above the 1931 January level. After February, when an increase in plane production counterbalanced the decrease in engine manufacture, both lines dropped off gradually, in contrast with the sharp rise of the previous year's production to the usual June peak.

Total manufacture of both airplanes and aircraft engines during the first half of the current year was valued at slightly more than a third below the figure for the same period of last year.



Airplane production by months, 1931 and 1932.



Valid airplane licenses and identifications.

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FOREIGN TRADE
(Page 129)

Aeronautical Exports
(July 1932)

Airplanes, seaplanes and other aircraft....	$52,000
Engines for aircraft.....	150,480
Parachutes.....	6,130
Other accessories and parts.....	87,131

AERONAUTICAL EXPORTS for July bettered the previous month's figure by 49 per cent, with a total of $295,741. Compared with July 1931 the current sales slightly overreached the half-way mark, largely due to the continued demand for American engines abroad. Soviet Russia headed the list of engine purchasers with a bargain lot of 195 at about $90,000, while Sweden's order for three high-powered units put it next in line. Venezuela dominated the month's market for airplanes. More than a fourth of the total shipments of parts and accessories went to Japan, with Turkey in Asia making a very poor second in this group of 43 countries.

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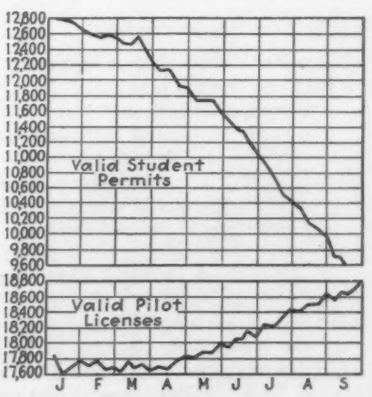
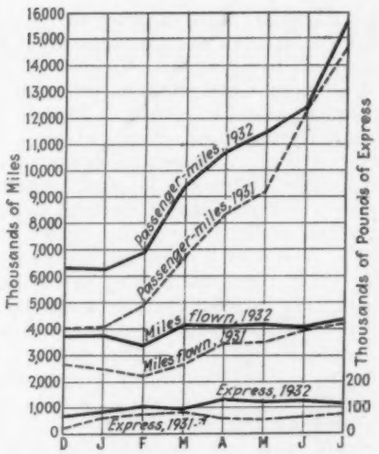
AIR TRANSPORT
(Page 102)

SCHEDULED AIR TRANSPORT operations during the first half of the current year attained new heights, despite the deleterious affects of the general business depression. Transport planes flew 24,668,414 miles, a fifth more than in the same period last year. Not only did more people use the airlines than during the first half of 1931, but they also flew further than the average 1931 passenger. Passenger figures showed an increase of 29 per cent, to 248,954, while passenger-mileage went up 34 per cent, totalling 63,529,538. These figures are from the Aeronautics Branch of the Department of Commerce. The Aeronautical Chamber of Commerce is the source of the monthly totals which form the basis of the chart.



Valid pilot licenses and student permits.



Scheduled transport operations by months, 1931 and 1932.

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AIR MAIL
(Page 106)

Air Mail Operations
(July)

Mileage scheduled.....	3,090,503
Mileage flown.....	3,076,542
Pounds of mail dispatched.....	545,060
Amount paid to contractors.....	$1,750,745

FIRST definite evidence of the effect of recent increases in air mail postage is found in the Post Office Department's report of July operations. Poundage of mail dispatched during the month was 30 per cent under July 1931 and 22 per cent below the figure for the preceding month this year. A similar comparison of mileage figures shows an increase of fourteen per cent in distance flown by air mail planes during the past July as against the same month last year. Mileage flown during June 1932 was bettered by almost 6 per cent. The amount paid to contractors during July was about 4 per cent under the 1931 figure of $1,816,742, but quite up to the normal 1932 level. Department shortages at the end of the fiscal year left only $1,100,000 to be divided among contractors during June.

NEWS OF THE MONTH

Britain pushes up the ceiling

DELVING farther into the stratosphere than ever airplane went before, a five-year-old Vickers Vespa brought to Great Britain on Sept. 16 another world's record. Piloted by Capt. Cyril Uwins, chief test pilot for the Bristol Airplane Company, the especially lightened biplane, powered with a 550 hp. Bristol Pegasus engine, reached 43,976 ft. over the Severn valley. Well over 8 miles up, this exceeds by 800 ft. the altitude record established by Lieut. Appollo Soucek of the U. S. Navy on June 4, 1930, but is still almost 2 miles below the heights reached by Auguste Piccard and his aide in their balloon a month before. Though confirmed by the Royal Aero Club, the record will not become official until ratified by the F.A.I.

A brace of records for flights with commercial loads was secured for France in trials over Villacoublay during September. With a 500-kg. load (1,102.3 lb.) M. Signorin reached 33,784 ft., about 3,000 ft. better than the existing world's altitude record for the class, which will hold, however, until official calibration is received. The American record in the same category is 28,143 ft., reached in 1924 with an Army-built two-seater pursuit by Li ut. Harold R. Harris, then of the Army Air Corps and now general manager for Pan American-Grace Airways on the West Coast of South America. Another French pilot, M. Gustave Lemoine, test pilot for Henri Potez, broke the speed record for planes carrying 1,000 kg. (2,200 lb.) of "dead" load. Flying a Potez 50 A2, powered with a Gnome-Rhone K-14 700 hp. engine, over a 310-mile course he averaged 183 m.p.h. Lee F. Schoenhair, pilot of the Goodrich Rubber Company, held the previous record of 176 m.p.h., with Lockheed Vega.

Flying a 500-km. circuit in the Loire Valley, Marcel Haegelen set a new world speed mark for the distance of 2,000 km. (1,240 miles). The same Henriot-Lorraine 230 hp. monoplane in which he captured the Coupe Micheline last July averaged 164 m.p.h. for the distance.

Closed-circuit distance records and all duration records are omitted from the new record listing adopted by the Federation Aeronautique Internationale at its current annual conference held at The Hague in early September. With a single exception the proposals of the F.A.I. sporting commission, approved by the contest committee of the National Aeronautic Association several months ago (AVIATION, August, 1932, p. 364), are embodied in the revised listing. The suggestion of the chairman of the commission that all feminine records be abolished was not carried out. Records for women will continue to be recognized in all categories.

Engine trouble has caused another intermission in the leisurely round-the-world flight of Captain Wolfgang von Gronau and his three companions. Forced down in the Bay of Bengal, almost 100 miles from the Burma mainland, their Dornier Wal flying boat was towed by the British steamer Karagola to Rangoon, where broken water pump and cracked propeller could be repaired. In the course of its return flight to Germany the Dornier Wal made the first direct flight from Hongkong to Manila, posting 6½ hours as the time for the 650-mile stretch.

Intercity records are again popular targets for speed pilots. Col. Roscoe Turner, who took second place in the transcontinental race for the Bendix trophy, made a round-trip, non-stop flight between Los Angeles and San Francisco in two hours, 41 minutes. He also broke by seventeen minutes the one-way record established by James Wedell. At an average speed of 275 m.p.h. the round-trip took only ten minutes more than a one-way flight over a regular airline.

Autogiros reached a new high during the dedication ceremonies of a new National Guard hangar at Boston Airport. Capt. Lewis A. Yancey flew a 300 hp. Pitcairn to 21,500 ft. and a new world's record for the type. This is 2,300 ft. better than the previous record he made over Burbank, Cal., last May.

Ready for a new regime

Coincident with its completion of five years of service between New York and Chicago, the National Air Transport division of United Air Lines recently applied to the Department of Commerce for the certificate which, under the new regulations governing air navigation will be required of all transport companies after Jan. 1. The essential artificial horizons, directional gyros, and altimeters have been installed in all passenger-carrying planes flying the New York-Chicago and Chicago-Dallas routes. All pilots of the division have qualified under the new instrument flying regulations for the scheduled air transport master pilot's rating as have all American Airways' pilots on the Boston-New York routes. United's Pacific division, which celebrated the sixth anniversary of its Seattle-San Diego operations in mid-September, approached perfect operation during August with 99.96 per cent of the scheduled miles actually flown.

Since Sept. 25 Ludington Air Lines have been operatnig half their ten hourly trips between New York and Washington on express schedules. Fleetsters fly the even-hour schedules with no stops between the two cities, while the odd-hour schedules are operated with Stinson tri-motors landing at Philadelphia and Baltimore. Stinsons continue to fly the regular Washington to Norfolk service. The New York-Washington fare is the same on all schedules — $12.95 — and no changes have been made in other one-way and round-trip fares.

Boston's long-awaited air connection with Albany and the transcontinental planes of American Airways may soon be provided by the Inter-City Airlines, newest addition to the air transport family. Tentative plans of the young line, which has carried almost 600 passengers between Springfield and Boston in about five months' operation, are for a local service with flag stops at Worcester and Pittsfield.

Night air mail flights between San Diego and Salt Lake City, discontinued by the Post Office Department last January, have been resumed. Leaving San Diego at 7 p.m., the eastbound Western Air express plane arrives at Salt Lake at 2:30 in the morning. Westbound, an 11:15 p.m. departure brings the night mail to San Diego at 7:30 a.m. This gives Los Angeles, next to the last stop on the route, six transcontinental schedules in each direction daily, two each on the southern routes of American Airways and Transcontinental & Western Air, and two on Western Air connection with United at Salt Lake City.

Selling air mail service

With the close co-operation of the Post Office Department and at the suggestion of Second Assistant Postmaster General W. Irving Glover, the Aeronautical Chamber of Commerce has launched a nation-wide program to acquaint the general public more fully with the air mail service. The air transport section of the Chamber and its transport company members are handling the job. Posters for mail trucks and Post Office lobbies and

stickers for mail chutes and air mail letters are especially emphasizing the advantages of air mail use to cities not directly on air lines. Further assistance from local civic organizations, postmasters, and major users of air mail will, it is hoped, provide favorable circumstances for a fair trial of the new air mail postage rates, which operated in their first month after going into effect to produce a drop of about 20 per cent in total air mail poundage.

A step in the improvement of foreign mail service is the provision for two additional connecting schedules for Baltimore. Eastern Air Transport's planes carrying mail and express between New York and Miami where schedules to the West Indies and Central and South America are met, now stop at Baltimore northbound at 8:35 a.m. and southbound at 5:45 in the afternoon. Previously only the passenger planes, operating between New York and Richmond, served Maryland's capitol city.

Resignation of three of its executives precipitated a reorganization of the Eastern Lines operations division of Canadian Airways. To provide for an extension of its air services and existing activities the new organization is divided into three functional groups, traffic promotion and selling, operation and maintenance, and an operations office and traffic administration. The operations of each group will be entirely independent of the others, the sales managers of the promotional unit having, for instance, no part in the performance of the service which they promote. Heading the operations and traffic office, an operations general secretary also co-ordinates the activities of the other two groups.

Interest is being stimulated in the formation of a Canadian section of the empire-wide Guild of Air Pilots and Navigators. Not a trade union but a professional guild comparable to that of the Master Mariners, it enjoys the high patronage accorded the guilds as an important British tradition.

Through tickets

Direct air transport connection between all cities served by Transcontinental & Western Air and Pan American Airways is provided by a traffic agreement recently completed between the two lines. Similar to interchange arrangements for mail and express, which have been in effect for some time, it permits the purchase of a single ticket to any major city in South or Central America and the West Indies. At the new Airlines Ticket Office opened by Eastern Air Transport late in September in the Shoreham Building in Washington, D. C., too, complete ticket facilities are provided for all airway points on all major airlines in the Western Hemisphere.

Money orders by air mail from England to South and South-West Africa are the newest service announced by the British Postmaster-General, who recently introduced special air post cards. In the same air mail with the order official confirmation from the Money Order Department is dispatched, with a charge of 22 cents irrespective of the amount of the order.

Colonial pros and cons

Under a provision of the semi-public Beit Trust some $200,000 is to be devoted to the improvement of air communication in Africa. About $50,000 has already been earmarked for work in Rhodesia along the Cairo-Cape Town section of Imperial Airways. Four new emergency landing fields, improved runways for fourteen others, and the extension of facilities for wireless communcation between aircraft and ground stations are scheduled for accomplishment during the next two years.

Australian aviation has been engaging in civil war. Two national organizations have been in conflict with each other over the policy that should be recommended to the government, and the present scheme of subsidies, most of which go to one company, has been hotly attacked, both from within the government as extravagant, and from within the aeronautical industry as monopolistic and not producing the results intended. Among the issues in conflict is the development of air service between Europe and Australia. One faction wishes to wait until Imperial Airways has advanced far enough to provide for all-British-Empire service, while another would immediately cooperate with the Dutch K.L.M. and supply a connecting link from Australia to Java. The K.L.M. has expressed willingness to operate without special Australian subsidy, handling mail at a surtax of 2 shillings a letter.

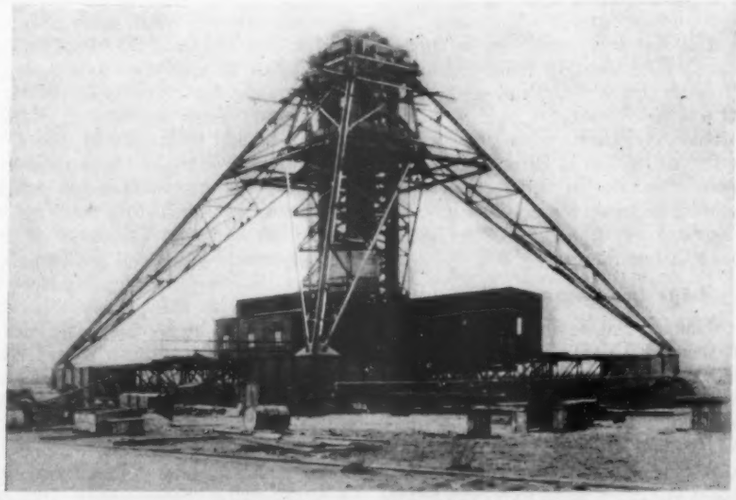
K.L.M. and Air Orient both have received permission from the Government of India to carry eastbound Indian mail from Calcutta. Dutch planes take the mail via Rangoon, Bangkok, Penang, Medan, and Palambang to Batavia (Java), while the French planes after following the same route as far as Bangkok go on to Saigon (Indo China). The French and Dutch lines, whose routes coincide from Bagdad to Bangkok and from Marseille in the winter, have decided to co-operate, as far as possible maintaining uniform charges and traffic conditions.

Air mail connection with Europe for the south of India was inaugurated by Tata & Sons, great Parsee merchants of diverse activities, on Oct. 15. Mail is carried weekly from Madras, via Ahmedabad, Bombay, and Bellary, to connect with Imperial Airways' Croydon plane at Karachi. About 14 cents per half ounce is charged in addition to ordinary postage.

Co-operation between the K.L.M. and Aerotransport Aktiebolaget, the Swedish monopoly, insures maintenance throughout the winter of the Copenhagen-London and Copenhagen-Paris services usually discontinued in October. Twelve-passenger Fokkers leave Copenhagen at 8:55 a.m. and reach London and Paris at about 4 p.m.

Air transport—wholesale

New low rates are in effect for air travel in northern Europe. In addition to reductions of 30 instead of 10 per cent on the return half of round-trip tickets the Farman lines, Deutsche



NEW HITCHING POST

Electric motors raise the telescopic, self-propelling mooring mast for the Akron and Macon at the U. S. Naval Air Station at Sunnyvale, Cal., 160 ft. into the air. With the nose of the zeppelin made fast the 500,000 lb. mast retracts to 75 ft to tow the airship in to dock.

Lufthansa and Deruluft, the Russain transport organization, have agreed to make further reductions on tickets sold in groups of three or more. From Paris to Berlin four or five tickets are allowed 10 per cent and six or more, 20 per cent, off the list price. Twenty-five per cent discount on each outgoing ticket and 30 per cent on the return half is the inducement offered to three or more persons to travel together between Berlin and Moscow or Leningrad.

Air service between Tallinn (Estonia) and Warsaw, via Riga (Latvia) and Vilna (Lithuania) has been opened by the Polish air transport company Aerolot. Scarcely more than the second class railway fare is charged for the nine-hour trip.

With its ratification by Italy the Warsaw Convention for the Unification of Regulations Relative to the Responsibilities of Air Transport Companies for Injury to Persons or Goods Carried became effective, in accordance with the requirement that five signatory countries should deposit ratifications in Poland. Brazil, Spain, Rumania and Yugoslavia had previously done so. The convention, which will of course apply only as among the ratifying States, limits liability for the death of a passenger in international transport to $5,000.

The Graf chalks up a new one

Stiff competition even for the projected trans-Atlantic air mail was offered by the Graf Zeppelin on its mid-September flight to South America. By combining Lufthansa and Condor Syndicate services with that of the Zeppelin, mail was delivered in Rio de Janeiro four days after it had been posted in Berlin. So satisfactory has the Graf's operation been this year that the Hamburg-American line is offering it as a regular feature of its triangular three-continent tours. Travelers may cross the North Atlantic on a ship of the line, make the trip from Europe to South America by airship, and return north again by boat.

Another contribution to the speed of German air mails is direct connection between the Berlin Post Office and Tempelhof airport by pneumatic tubes. The stretch of 6 km. (3.7 miles) is covered in ten minutes.

Navy bags the Bennett Cup

At Dukszty, close to the Polish-Latvian frontier, a U. S. Navy balloon landed on Sept. 27 to win the James Gordon Bennett Cup Race from a field of sixteen. Forced down by a valve defect, it had traveled 921 miles since its departure from Basle, Switzerland, in storm and high wind two days before. About the same distance was covered by the winner of the National Balloon Race this past summer, Army No. 2, which was not entered in the International event. The navy bag had exceeded by about 90 miles the distance of Goodyear VIII carrying Ward T. Van Orman, winner of the 1930 Bennett race, out for his third straight victory and permanent possession of the cup. Petit Mousse, the French entry, made third place and the Polish Polonia fourth. Lieut. Commander T. G. W. Seattle and Lieut. Wilfred Bushnell, winners of the 1931 races in this country, piloted the Navy entry.

BELOW THE YOSEMITE RIM

The Pitcairn autogiro owned by the Champion Spark Plug Company is one of the few aircraft which have successfully landed between the 3,000 ft. walls of the canyon.

Berlin has an air show

Orville Wright's 1909 plane, the tiny Klemm which Elli Beinhorn, popular German woman pilot, flew around the world, and a convertible week-end plane which can be used also as car and boat were among the exhibits at the German Air Sport Show opening in Berlin on Oct. 1. Held under the auspices of the German Aeronautics Association, it is probably the most extensive exhibition ever made of the history of aeronautics, model aircraft and the most recent developments of industrial and home manufacture in flying judged purely as a sport. Due to the prohibition of military aviation in Germany by the Versailles Treaty and of governmental subsidy even to sport flying, except gliding, by the Paris air agreement of 1926, flying has been taken up with great enthusiasm by individuals and private organizations. Nazi flying squads and Socialist Sturmvögel are among the groups giving young Germans an opportunity to learn to fly.

Poor weather and light winds restricted the activities of the seven sailplanes and two secondary gliders entered in the British Glider Association's Open Soaring Competition this year. Held on the Furness Gliding Club site at Moorside, near Askam-in-Furness, it included only five days at all possible for flying. On the last day of the meet the flight of longest duration was made in a Kassel two-seater, which stayed in the air two hours and 38 minutes. A new glider distance record for Great Britain (13¼ miles) was made by the same pilot the same day.

Among the new regulations announced by the British Air Ministry as effective this January is the requirement that all planes desiring airworthiness certificates be equipped with fuel gauges. They have heretofore been obligatory only for commercial and military planes. Also after the new year official control will be imposed on flying instructors, who will be required to hold certificates from approved schools or from the R.A.F. No special certificate is required in this country, except for teachers in approved schools.

Hungary increases its budget

Decreases are not the order of the day in all national exchequers. Appropriations for aeronautics in Hungary for the 1932-1933 fiscal year are five times the previous year's figure. Most of the current budget of $1,314,000 will be for the replacement of obsolete and worn out planes on the domestic air services, but must be expended within the country.

France, however, has cut almost $8,000,000 from the air budget for the

year beginning Jan. 1, 1933. While the allowance for new aircraft and equipment is reduced most drastically, experimental and research weeks and subsidized transport companies also will feel the pinch.

Civilians set the stage abroad

Both French and Italian populations have had a foretaste of the horrors of aerial warfare in recent weeks. All eastern France participated in maneuvers to test the efficiency of a new system for the detection of air invaders. Cities were darkened and even railroad trains ran with lights covered while three separate air raids were made by squadrons of bombers. The Italian Air Force made its first experimental night bombardment over the city of Rome. "Bombs" were "dropped" on the darkened houses while ambulances and fire engines dashed through the streets and searchlights, anti-aircraft guns and other means of defense were tested.

Bombing in this country has been more narrowly restricted. Teams from each Air Corps squadron competing for 1932 marksmanship honors at the annual matches at Langley Field, Va., dropped bombs from 5,000 and 8,000 ft. at a target 200 ft. in diameter. Scores for the three wining teams were, 1,932, 1,920 and 1,872 out of a possible 2,000, a decided improvement over the records made five or six years ago with the same equipment. Lieut. Ladd and Offutt, of the 2nd Bombardment Group at Langley Field, were the winners.

A flight through the Grand Canyon climaxed the training season of the 9th Bombardment Squadron, stationed at March Field, Riverside, Cal. With news reel and feature camermen as passengers the squadron flew up and down in formation, 1,000 ft. below the rim.

In almost record time a formation of six B/J P-16 two-seater pursuit planes of the 94th Squadron made a round-trip dash from their home base at Selfridge Field, Mich., to Rockwell Field, San Diego. The 2,150 miles westward were covered in eighteen hours and fifteen minutes with three stops for refuelling. On the last leg of the return trip the average speed was 182 m.p.h.

To test the mobility and scouting efficiency of the aerial battle force, and incidentally the ability of its navigators, six patrol planes from the fleet air base at Pearl Harbor flew non-stop from Oahu to French Frigate Shoals, some 500 miles west of the main Hawaiian group, where no airplane had ever been before. Thirteen small islands and a rock rising 120 ft. out of the water were the only landmarks.

Scouting planes for the Navy

Several new experimental planes have been delivered recently to the Naval Air Station at Anacostia, D. C. From the Grumman Aircraft Engineering Corporation comes the XSF-1 scouting plane, similar to the XFF-1 two-seater fighter delivered by the same company some time ago, but powered with a Pratt & Whitney Hornet instead of a Wright Cyclone. The new General fighter, XFA1, has been returned to the station by the General Aviation Corporation after some modification. Still another addition to the fighter line is the XFJ-2 from the Berliner-Joyce Aircraft Corporation.

Boeing Airplane Company's Seattle factory has been going full steam on a navy order of 54 F4B-4 carrier fighting planes scheduled for completion in mid October. The first was flown to Anacostia, fifteen go by rail to San Diego, sixteen to the Marine Air Corps base at Brown Field, Va., while the others are allocated to the Battle Force and ready for fly-away delivery. Powered with Pratt & Whitney Wasps, they carry two machine guns, deck arresting gear, bomb displacing gear and 232 lb. of bombs, and radio equipment.

American invasions

Recent sales abroad by United and Curtiss-Wright export organizations attest the growing popularity of American aeronautical products in the foreign market. A million and a half dollars worth of planes, engines and propellers have been ordered from United Aircraft by Brazil and Persia. Fourteen Boeing pursuit planes and 23 Vought Corsairs, all equipped with Pratt & Whitney Wasp or Hornet engines and Hamilton propellers, and a quantity of spare parts go to Brazil, where Vought planes have been used in the navy for years. The Brazilian army, for which the Boeings are destined, has heretofore been faithful to European aircraft. Forty supercharged Pratt & Whitney Hornet engines with spares, and 40 Hamilton Standard propellers, form the initial invasion of the Persian market by American aircraft in quantity.

A shipment of 24 Curtiss Hawks recently made from the Buffalo plant to Turkey is another first, previous purchases of Turkish military equipment having been placed exclusively with European manufacturers. The new 700 hp. Cyclone F engines power these Hawks, which are also equipped with a new type of single-strut landing gear. Negotiations with the Turkish Government which resulted in this order also included the development of factory operations at the Turkish airplane manufacturing plant at Kayserie, where Hawk pursuit planes and Curtiss Fledgling training machines will be manufactured as part of an extended aviation program. The shipment of military planes was followed by two twin-engined Curtiss Kingbird transports to start the first airline in Turkey.

Eleven transport ships for use on American airlines are under construction by Curtiss-Wright Airplane Company at the St. Louis plant. To be delivered in March, the new Condors will carry fifteen passengers in addition to a mail load, are powered with two 700 hp. geared Wright Cyclone engines. five go to Eastern Air Transport, while the other six will be flown on Transamerican Airlines. The total order amounts to more than $500,000.

An increased rating has been granted by the Department of Commerce to all the engines of Wright Aeronautical Corporation's Whirlwind series, listing the 300, 240, and 165-hp. units as 325, 250, and 175 hp. respectively.

Curtiss-Wright Corporation, which showed a profit in its semi-annual report for the first time this year, has further strengthened its position by paying off bank loans amounting to $645,000, partly through the sale of stock. The bank loan item, which has been listed among the current liabilities since 1929 and which at one time ran as high as $5,400,000, is now completely eliminated. Current assets on June 30 totaled $8,414,000 against current liabilities of $2,729,000, a ratio of 3:1. At the close of 1931 the ratio was 2.6:1, with assets of $9,424,000 and liabilities amounting to $3,618,000.

Shortly after the announcement of the receivership of Alexander Industries last August an organization composed largely of its ex-employees was formed to lease the factory, machinery and equipment and maintain operations. Under the name of Aircraft Mechanics, Inc., it will continue to build both the Eaglerock biplane and the Flyabout, and to furnish replacement parts and repair all makes of planes under its approved repair station certificate.

Cornelius Aircraft Corporation has leased the former Apache Motors Corporation plant at the Metropolitan Airport in Van Nuys, Cal., to undertake the development of a new two-place, side-by-side pusher monoplane. Powered with a Martin 333 engine, it embodies the principle of the Cornelius "Fre-wing," flight-tested early in 1931. [Described in Flying Equipment in the May, 1931, issue of AVIATION.] John Cornelius is president and general manager of the company, and E. M. Graves its chief engineer.

Taking over the Curtiss-Wright Flying Service base, the Air Service & Equipment Company has opened a repair, storage, and flying service at the Atlanta Municipal Airport.

Private planes by Heinkel

Production for the private owner has been begun by the Heinkel Company of Berlin on its model HE 64. One of the five planes of the type specially built for entrance in the International Rundflug this year took second place in the event. Much attention was also

centered on them during the Week-end Aerien in England, when a large group of continental pilots were entertained by British sportsmen pilots.

Further assistance from its creditors in the form of a one-year moratorium on all debts has been secured by the Junkers Aircraft Operating Company of Dessau, Germany. After an accumulation of financial difficulties early in the year (reported in the May and June issues of AVIATION) caused a suspension of payments, Junkers creditors and the city of Dessau formed a limited operating company to maintain the activities of the factory which employs some 3,000 men.

Deutsche Lufthansa, whose fleet of 141 planes is largely of Junkers manufacture, reports a negligible profit (less than $1,000) from its 1931 operations. Unfavorable economic conditions shared with the 100-mark ($23.63) government fee levied on all nationals leaving the country the responsibility for this condition.

First to make a nine-months' report for 1932, the Douglas Aircraft Company of Santa Monica, Cal., earned $173,388 during that period, after depreciation, federal taxes and other charges, 50 cents a share on 342,304 shares outstanding as compared with $1.60 a share or a total of $549,331 for the nine months ending Aug. 31, 1931. Profits for the quarter just ended were $37,816, a little more than one-fourth the corresponding 1931 figure.

Personnel

Transamerican Airlines Corporation, operating subsidiary of Thompson Aeronautical Corporation, has announced the election of John L. Ruden as vice-president of operations, and Paul A. Wright as vice-president of business relations. Both men have been associated with T.A.C. since the initiation of its air transport, sales, and service operations in 1928. Ruden as operations manager had helped inaugurate the first transcontinental air mail service, from which he resigned in 1928, while Wright's early experience was in the investment banking field.

Frank Le Man, affiliated with the Curtiss-Wright Airports Corporation for the last two years as base manager at Moline, Ill., and Columbus, has been appointed manager of Curtiss-Wright Airport at Caldwell, N. J.

James A. Richardson, acting general manager of Canadian Airways, since their organization in December, 1930, has resigned to give his full attention to his grain business and other interests and has appointed Wilfred C. Sigerson, comptroller of the company, to act in his stead until further notice.

F. T. Jenkins, formerly sales manager of the survey-photographic department, is now acting general manager of Canadian Airways' Eastern Lines.

SIDE SLIPS

By Robert R. Osborn

WE THINK it was a stroke of pure genius, for the reporter of the *Daily Local News*, West Chester, Pa., to put these two paragraphs together, in his report of a local air meet:

"It may be interesting to know that there were 1,382 cars parked at the airport during the air meet, twenty pilots entered in the various events, 28 planes on the field representing three States, 248 passengers taken up, 5,021 tickets sold, 1,500 bags of peanuts sold, 872 bottles of soft drinks, 2,150 dishes of ice cream, two large barrels of root beer, 150 hot dogs and 100 ham sandwiches. The commissaries had to renew their supply three times, even then turning away many customers.

"The Malvern Fire Company was on hand with up-to-date apparatus. The Minquas Fire Company, of Downington, had an ambulance on the scene, with a doctor and two nurses from the Chester County Hospital, fortunately they were not needed."

Thanks to H.W.B., of Dundalk, Md., for the clipping.

The foregoing article continues: "Jackie Sommers, the oldest professional parachute jumper in the United States, who hails from Los Angeles, Cal., thrilled the crowd by making a delayed opening, going up to 4,000 ft. he bailed out, dropping into space, turning end over end, he did not pull the rip cord until within 1,500 ft. of the ground, landing on his feet like a bullet, just a few feet from the center of the field. Jackie, who is 52 years of age, has been jumping from balloons and airplanes for the past 30 years, and only broken two ankles, which is somewhat of a record for a jumper."

That must have been the time he landed on his feet like a 16-in. shell.

Mr. F. A. W. of Buffalo thinks that Robert Ripley, famous "Believe It or Not" artist has at last turned out one

item which is a little difficult to believe.—"Hanging like a huge kite 3,000 feet *below* the Chicago municipal airport, a cabin monoplane remained stationary for almost an hour, with air mail pilot Howard Stark at the controls."

We read that Roosevelt Field is starting an aviation museum, containing a collection of old pusher airplanes, old engines and many other relics of bygone days in aeronautics. As the printed list of the relics on exhibition did not include one, we propose to send them an old financial statement of an airplane manufacturing company, printed entirely in black ink.

We see by the papers that a farmer has traded a cow for some flying lessons. Having had a bit of experience with each, we are sure that the new

owners are going to find that for both cow and flying lessons the upkeep is far more of a problem than the initial cost.

"B. took off over the water, but the motor stalled in the ascension and he headed back for the field. The plane dived, crashing on its nose. Investigators of the crack-up attributed the escape of B. and his passenger to the pilot's good judgment."—N. Y. *Herald Tribune.*

That's where pilot judgment counts, allright—in that maneuver of diving and crashing on the nose.

Mr. W.W.F. of Miami, Fla., offers a possible explanation for the mysterious high speeds some designers claim for their new models: "The former Army flier reported favorable weather throughout the route. Somewhere along the route his ship lost the streamline paint on the tail wheel."—Clipping from the Miami *Herald.*

"FRANCE SEEKS OCEAN AIRLINE WITH BUOYS ACROSS TO ARGENTINA."—New York *Times* headline.

On the nice clear bright days can't you imagine the pilots on that line leaning back in their seats and saying to themselves "Oh buoy, Oh buoy, Oh buoy." [Note to the Editor: Terrible isn't it? But I've actually heard of a few people who really like puns.]

FLYING EQUIPMENT

A new policy and a new airplane

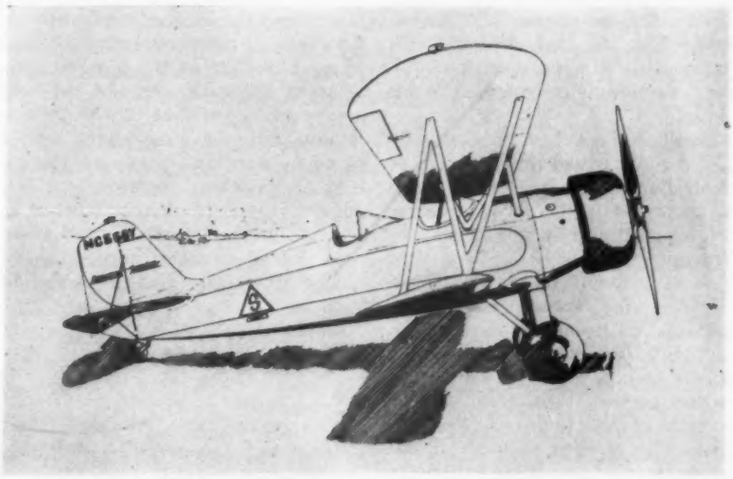
STEARMAN Aircraft of Wichita, subsidiary of United Aircraft & Transport Corporation, is offering through a widely-distributed dealer system the Stearman Sportster for 1933. Co-incident with the release of a description of this airplane comes an announcement that it is to be built on a strictly custom basis, orders to be filled 45 days after receipt.

The airplane is a "cleaned-up" biplane along conventional lines for two people and their baggage. It may be flown also as a single seater, at slightly improved performance, with a detachable cover in place over the front cockpit.

The forward portion of the fuselage is practically circular in shape, carrying out the lines of the N.A.C.A. cowling around the 210-hp. Continental R-670 engine. Beginning about at the front cockpit the circular form is changed gradually into a narrow oval shape at the tail, which is carried upward smoothly into the built-in fin. The lower wing, which is almost narrow enough (as compared with the upper wing) to justify calling the airplane a sesqui-plane, fairs smoothly into the under part of the fuselage below the front cockpit. The combination of narrow lower wing and a wide-angled cabane structure affords unusually good visibility, both for pilot and passenger.

The most obviously different feature of the design is in the arrangement of the landing gear. Basically, it is of the split axle type, with the wheels carried on a pair of V struts hinged together along the median line in the under part of the fuselage. The shock-absorber leg on each side, however, is mounted in an almost vertical position, its upper end being carried on a full cantilever outrigger from the lower longeron. The outrigger is ahead, and independent of the leading edge of the lower wing. All members and fittings are fully streamlined. The magnesium alloy wheels fitted with large surfaced brakes carry 7.50x10 low-pressure tires. The tail wheel, which is mounted just forward of the stern post, carries an extra-low-pressure tire. The wheel is so mounted that it may be turned to a full 360 deg. on the ground, but it is sufficiently restrained at the trail angle in the air to prevent ground looping or oscillation on landing.

The general specifications of this airplane as given by the manufacturer are: Length, 24 ft. 6 in.; height, 9 ft. 0 in.; span, 33 ft. 0 in.; wing area, 276 sq.ft.; wheel tread, 7 ft.; weight empty, 1,585 lb.; total useful load, 915 lb.; gross weight, 2,500 lb.; wing loading, 9.05; power loading, 11.9.



The Stearman Sportster for 1933.

Pitcairn builds a cabin autogiro

FLIGHT TESTING is now under way at the Willow Grove Field of Pitcairn Aircraft, Inc., of a new autogiro which is not only the largest machine of this type so far attempted, but represents the first true cabin design in this country. The machine bears some resemblance to the two-place, three-bladed giro which appeared in England some months ago, although in details and in arrangement, modern American cabin monoplane practice is followed. Accommodations are provided for four or five people. Dual controls of the swing-over-wheel type are installed. The cabin is fitted with lights, heater, ventilator, window regulators, etc., and is insulated against heat, cold, and sound, with a fireproof material.

A number of external changes are evident. Aside from a general cleaning-up of the fuselage, the struts of the pylon have been completely enclosed in a bonnet-like sheet metal housing. The only exposed member is the rotor starting drive shaft. The rotor and its mounting follow standard Pitcairn practice, having four blades fitted with the usual droop and spacing cables. The fixed wing and the undercarriage have been completely redesigned, however,

The Pitcairn cabin giro

with an eye toward improvement of aerodynamic efficiency and structural simplicity. The wing system is in three parts,—a stub built integral with the fuselage carrying the landing gear (as is common in low-wing monoplane practice), and two tip sections. The latter, which carry the ailerons, are rigged with a considerable degree of dihedral with respect to the stub section. All sections of the wing are of the full cantilever variety with completely internal bracing.

The undercarriage has been greatly simplified. Each wheel unit consists of a vertical shock strut in a streamlined housing carrying the axle and semi-airwheel, braced laterally and to the rear with streamlined struts.

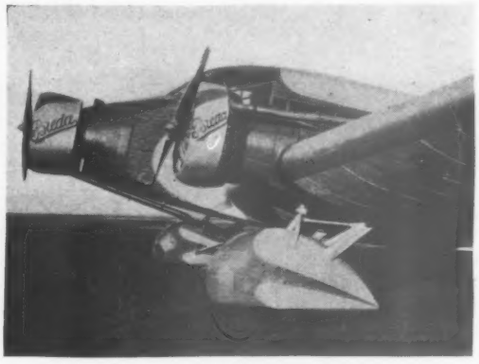
The tail surfaces represent a departure from the conventional. The stabilizer is in its usual location, but the elevator is not divided, having the same span as the stabilizer. The usual central fin and rudder has been dispensed with entirely. Two fins and two rudders, disposed symmetrically about the plane of symmetry, are supported by the stabilizer.

Italian transport with American engines

THE Italian firm of Ernesto Breda of Milan, has recently produced in the "Breda 32" a commercial airplane, which in appearance, engineering and performance, compares favorably with transport machines of other countries. Careful study has apparently been made of the requirements of the passenger, operator, and manufacturer, which has resulted in a well-balanced design.

The Breda 32 is a low-wing all-metal monoplane, powered with three radial air-cooled engines providing accommodation for ten passengers, their baggage (up to 440 lb.) and two pilots. Of interest to Americans is the fact that Pratt & Whitney Wasp Junior engines were selected for the original model, although the design is adaptable to many other radial engines having a power range of from 320 to 350 hp. The Armstrong Siddley "Double Mongoose," the "Piazzio Stella," the "Fiat A55," or the Gnome et Rhome "Titan Major" are suggested at alternates. One engine is mounted in the nose of the fuselage, and the two outboard engines in nacelles faired into the leading edge of the wing. Checking in a practical way the findings of the N.A.C.A. with regard to optimum location for wing engines, the nacelles are so arranged that the propellers are in line with the wing chord with their plane of rotation approximately 25 per cent of the chord ahead of the leading edge. This arrangement is to be found in the latest American transport, the new Boeing commercial monoplane.

The full cantilevered tapered wings of the Breda are of particular note because of the incorporation of the monospar principle, an arrangement recently exploited by certain British designers, and which has appeared at least once in an American design. In the present instance, all wing loads are transmitted to the fuselage through a large tapered box girder of the lattice type built up of duralumin channels. The girder provides support for the outboard engine mounts and also for the landing gear, and the leading and trailing edge portions of each wing rib are cantilevered out from it. Ailerons are carried on false spars. The connection between the wing and fuselage is made by means of cup-like screwed fittings similar to those employed in Junker's designs. Gasoline tanks are fitted in the leading edge of the wing, outboard from the engine nacelles. All tanks are fitted with quick-acting dump valves operated from the cockpit. Although each tank has an individual filler opening, arrangements are made so that the filling of all tanks can be made from a common central connection.



Nose of the Breda 32

The duralumin cover used on wings, fuselage and tail surfaces is of interest in the manner in which it is corrugated. The sheet, instead of carrying continuous corrugation as is commonly found in the Ford and Junkers designs, has been rolled or pressed into a pattern of discontinuous staggered corrugation somewhat similar in appearance to certain types of industrial stair treads marketed in this country. Deformation of this type undoubtedly adds considerably to the stiffness of the sheet with virtually no increase in the weight per square foot as compared with plain sheets.

The fuselage is of a semi-monocoque type. Tail surfaces, control systems and other auxiliary equipment appear to be conventional. The interior arrangement of the cabin is commodious and comfortable. Individual roller type window-shades are provided, an item which, although small, might well be given some thought by American transport designers.

Some of the general specifications as given by the manufacturer are: span, 87 ft. 6 in.; wing area, 914 sq.ft.; total horsepower, 960; weight, empty, 8,360 lb.; total useful load, 5,940 lb., including pay load of 2,980 lb.; maximum speed, 147 m.p.h.; cruising speed at 3,000 ft., 131 m.p.h.

Fairchild 22 equipped for blind flying instruction

For blind flying instruction

A FAIRCHILD 22 monoplane of Air Associates, Inc., equipped as an instruction ship for blind flying is shown in the photograph. The ship is standard in every respect except that the student is enclosed by the hood over the rear cockpit. The instrument board is fitted with a Sperry horizon and directional gyro, and Pioneer compass, altimeter, air-speed indicator, turn and bank indicator, and climb indicator. Light equipment of this type may prove interesting to flying schools and airlines alike.

TRANSPORT

Operations and Traffic Management

Bad weather cancellation card

IN CASES where schedules are delayed or cancelled on account of bad weather conditions ahead, United Air Lines has found that one of the best methods of explaining the situation satisfactorily to passengers is by a printed card headed "Safety First in the Air" from which the following lines are quoted:

"In air transportation, even more than in other forms of transportation, safe operation should be the controlling factor at all times. 'Taking chances with the weather' is a risk United Air Lines hopes to avoid out of respect to the safety of its passengers and its own personnel.

"The average experience of the 150 pilots employed by United Air Lines is approximately 4,500 hours. Like captains of ocean liners, they have gone through a thorough apprenticeship. We regard them as masters of a ship. The pilot's judgment is the last word in deciding when it is safe to fly. He is in more intimate touch with the situation than is any other person connected with the operation of the plane. Through our ground communication and radio facilities and his own intimate grasp of the situation he is in possession of facts with which passengers are not familiar and often if they did know certain facts they could not, without experience in air transport operation, interpret them correctly as the pilot does.

"Your pilot is under instructions to observe safety first with his passengers. If, in his judgment, conditions are such that flight cannot be continued with full assurance that it will be safely completed, he is under orders from the Department of Commerce, as well as from United Air Lines, not to take off, or to delay his flight until weather conditions are safe to fly in.

"We are pleased that, almost without exception, passengers recognize that when they are delayed by weather the pilot is acting in their interest and they appreciate that in air transportation, even more so than in other forms of transportation, safety should be the controlling factor at all times."

The cards are printed in a simple and dignified style on a good grade of white stock. They are placed in the hands of the passengers by the co-pilot or stewardess. This simple procedure has done much to allay a sometimes unreasonable attitude on the part of passengers annoyed by delays which may seem unnecessary to them from a lay point of view.

Lights show progress of mail along routes

A VERY interesting illuminated map showing the speed and range of air mail service originating in Denver to principle cities throughout the country has been designed and built by the employees of the Denver Post Office. It is being effectively displayed in prominent downtown store windows, in the lobbies of the main Post Office and substations, and in schools and civic clubs. Though the map is 8 ft. long and 5 ft. high and contains 114 bulbs, it may be transported easily.

Red, yellow, blue and green lights are used, a color for each of the four daily air mail despatches from the city. Each group of colored lights is shown in turn and each light within each group is flashed on in succession to indicate the progress of the mail across country. For instance, the 5:30 a.m. despatch is shown in red, the Denver red light being flashed first, then those at Pueblo, Albuquerque, Amarillo, etc. If the mail arrives at more than one city at the same time, the lights at those points flash on simultaneously. At the close of each progressive lighting of bulbs along the airways, all the bulbs of that color are lighted together for a few seconds to show the entire coverage provided by that despatch.

Tracing the progress of the mail is aided by entering close to the name of each city in the same color as used for the appropriate bulb the time of arrival and the letter S or N. The former means that mail arrives at that time on the same day it is despatched from Denver and the latter means the next day.

The illuminated air mail map which shows each dispatch from Denver

Short-cuts for Varney passengers

VARNEY SPEED LINES has developed new patronage by unusual attention to facilities for handling passengers at terminals. The operation of Lockheed Orion monoplanes between San Francisco and Los Angeles and San Francisco and Sacramento, has resulted in air speeds approximately 30 per cent greater than have heretofore been available, and a trans-bay air ferry amphibian service which connects the downtown business district with all Varney planes arriving and departing at San Francisco Bay Airdrome makes further time-saving possible. The Sikorsky ferry plane crosses the bay from the airdrome to Pier No. 5 on the San Francisco waterfront in about six minutes, as contrasted with the 30 minutes to a full hour required by bus and water ferry. The resulting saving in time can be shown for the San Francisco-Sacramento trip, which requires about 22 minutes flying time, and about ten minutes by bus at Sacramento. If the regular water ferry is used at San Francisco the total trip requires a minimum of one full hour from down-

town San Francisco to downtown Sacramento, a distance of about 80 miles, and the average time would probably be closer to an hour and a half. Through the use of the air ferry service, however, the total run can be made regularly in not over 45 minutes. The plane-to-plane hook-up is further improved by an automobile shuttle service at the San Francisco terminal, where a 7-passenger Graham sedan, of modern streamlined design painted in the Varney colors of red and white, operates between the amphibion dock and the Ferry Building, the downtown transportation center. The limousine service has effectively placed the airline terminal in the heart of the downtown district.

NEW VOLUMES FOR THE SHELVES

DIE HOCHSTRASSEN DES WELTLUFTVERKEHRS, *by Prof. Carl Pirath; Verlag von R. Oldenbourg; Berlin; 1932; 47 pages; $1 approximately.* Another of Dr. Pirath's careful statistical analyses of the economics of air transport, with special reference to inter-continental operation. The treatment is considerably too heavy for the ordinary reader, but anyone who is actively interested in trans-Atlantic transport service ought to make a study of the pamphlet.

QUESTIONS AND ANSWERS IN METEOROLOGY; *Commonweal Press, London; 1932; nineteen pages; 50 cents approximately.* Simply what the name implies. The questions are well chosen, and the general result is good as far as it goes, but it doesn't go very far. The selection of material is of course purely from the British point of view, and especially from that of the British Air Ministry's tests for civil pilots.

ZIVILER LUFTSCHUTZ, *by Richard Roskoten; Industrie-Verlag u. Druckerei Akt., Düsseldorf; 1932; 55 pages.* A summary of the question of air bombing, with special reference to gas attack from the air on civil populations and to the use of civil aircraft. Not as good as Vauthier's treatment of a similar subject in "Le Danger Aèrien."

FREEDOM OF PASSAGE FOR INTERNATIONAL AIR SERVICES, *by L. H. Slotemaker; A. W. Sijthoff's Uitgeversmij; Leiden, Holland; 117 pages; $1 approximately.* A general review of the law of international air transport, with special reference to the workings of the International Convention for Air Navigation. Presents a strong argument for a greater measure of freedom of passage. The author is associated with the K.L.M. air transport lines.

AN INTERNATIONAL AIR FORCE, *by J. M. Spaight; Gale & Polden, Ltd.; London; 115 pages; $1.25 approximately.* A review of the possibilities of internationalization either of civil aviation, as urged by several nations at the recent Geneva Conference, or of military air force, as proposed by the French. The author, one of the most distinguished of living experts on international law of the air in war and in peace, approaches the subject in a friendly spirit but concludes that the practical difficulties are for the present insuperable.

SIDESTRAND III AEROPLANE; *Air Ministry; H. M. Stationery Office, London; 1932; 70 pages; 90 cents approximately.* An excellent handbook on the design, construction, and rigging, and maintenance of a well-known British twin-engined bomber. Of marked interest for comparison with American practice.

PARACHUTE MANUAL, 1931; *Air Ministry; H. M. Stationery Office, London; 112 pages; 75 cents approximately.* An expert handbook on the use, care, and maintenance of the British Irving parachute, substantially identical with the American chute of the same type.

THE STORY OF THE AIRSHIP, *by Hugh Allen; Eighth Edition; Goodyear Tire & Rubber Company, Akron; 1932; 96 pages; 50 cents.* A well-known annual brought up to date, including new data on the Akron and Macon and on the Goodyear Company's commercial plans.

WHAT OUR READERS SAY

Birds versus airplanes

REFERRING to some of the questions brought up in the article printed in the July issue of AVIATION, regarding the effect upon airplanes of collisions between birds and aircraft, there have been frequent collisions of this nature in the Central-American republic of Nicaragua. In all cases the effect upon the bird has been most damaging and permanent. On the other hand there have been occasions where the aircraft has suffered very serious damage.

The country is blessed with an archaic scavenging and refuse-disposal system composed of large vultures which weigh as much as 10 or 12 lb. On account of their great numbers they offer a disagreeable and potential hazard. In areas where there is considerable flying they seem to accustom themselves to the presence of their mechanical rivals. In other areas, however, they display great curiosity and seem to resent the presence of the airplanes.

On one occasion a Fokker transport landed with a large buzzard imbedded in the plywood leading edge of the wing. Several years ago the impact of one of these birds carried away one of the wood interplane struts on a DH-4 airplane. The collision occurred at a low altitude and, as the pilot and observer were unable to utilize their parachutes, both were killed. On another occasion one of the vultures flew into a propeller and the resulting carnage was most embarrassing to the occupants of the open cockpit airplane.

Metal transport planes have experienced some collisions resulting in deep dents in the entering edges. Smaller observation planes with wood and fabric wings have had their leading edges crushed in as far as the front spar. It is interesting to speculate upon the effect in full flight where the impact is taken by a metal interplane strut. If the bird and airplane were going in opposite directions it is quite likely that the strut would be carried away. Another matter to consider would be the effect of a vulture striking an autogiro rotor blade.

LIEUT. I. W. MILLER
U.S.M.C.

Amateur builders

MR. LESLIE LONG'S letter relative to the lot of the amateur builder of aircraft, published in the July issue of AVIATION, has drawn forth a number of comments. Unfortunately it is impracticable to reprint them in full, but they can be summarized as showing that a good many people agree with Mr. Long. They express themselves with varying degrees of restraint and of feeling. Some of them merely advocate that State laws should permit local experimental flying by amateur builders, while others wholeheartedly revile the Department of Commerce and all its work—Ed.

SERVICING SHORT CUTS

Cylinder grinding jig

THE cylinder grinder installed in the Cheyenne shops of United Air Lines was originally furnished with a flat-plate fixture on which the engine cylinders were bolted by the hold-down flange during grinding. It was subsequently found that the pressure of the grinding wheel against the upper part of the cylinder was sufficient to deflect it somewhat and cause a slight taper in the cylinder barrel. To eliminate this difficulty, a heavy V-shaped bracket was bolted to the carriage bed of the grinder so that it straddled the head-end of the cylinder without touching it. Four bosses carrying heavy set screws were located so that the latter could be made to bear against the cylinder head flanges, on the same cross-section but 90 deg. apart. Thus, after the cylinder is bolted to the face plate the four set screws can be adjusted so that the alignment of the head and the base flange can be accurately maintained. Since this fixture has been in use no difficulties have arisen from tapered cylinders.

During grinding operations on this same machine, good illumination inside the cylinder is obtained from an electric light and a special reflector which can be bolted to either the intake or exhaust port of the cylinder. This arrangement can be seen in the accompanying picture, which illustrates a typical cylinder set-up in the Heald grinder.

Propeller servicing trucks

AN interesting and useful buggy for handling propellers has been developed in the Atlanta shops of Eastern Air Transport, Inc. It consists of a simple tubular steel framework mounted on a pair of pneumatic-tired wheels carrying two padded supporting arms upon which a standard metal propeller may be laid without danger of injury. A metal box carried between the wheels below the propeller, contains all the necessary tools and material for the installation or removal of propellers from engine shafts.

Engine transfer buggy

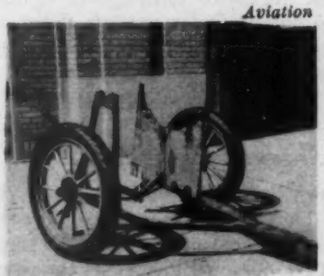
IN the October, 1932, issue of AVIATION, two methods of handling engines in and around the repair shop were illustrated. Both methods made use of hoists.

Another scheme which has been found useful, especially where engines must be moved over relatively long distances, involves the use of large-wheeled rubber-tired buggies. An arrangement of this sort developed and used by the Kansas City shops of Transcontinental & Western Air, Inc., is shown in an accompanying illustration. The framing of the buggy is of welded steel tube, and the wheels and tires are of the type used on motor-cycles. A flat plate, with suitable openings cut through it, bolted between the two members which serve as handles, provides a mount on which an engine may be fastened. The framework is so arranged that the engine may be supported either in a semi-upright position as shown in the picture (for hoisting the engine on or off the buggy, and for making adjustment to the accessories), or in a horizontal position for transfer or storage. With this equipment one man can easily move the engine from place to place about the hangar, but it usually requires two men to change from the horizontal to the upright position.

A similar buggy is in use at the Cheyenne shops of United Air Lines for moving engines between the servicing hangar and the engine overhaul shop, an outdoor distance of about 100 yd. In this case, however, the buggy structure is slightly more complicated inasmuch as racks have been added below the engine to receive the generator and starter units separately.

Another variation of the same idea has been worked up at the Pratt & Whitney engine servicing shop operated by United Airports of Connecticut at East Hartford. A Ford automobile front axle has been fitted with an angle iron horizontal yoke to which has been bolted a long wooden tongue or handle. One arm of the yoke, at the point of attachment to the axle, carries a steel plate bolted in an upright position, its plane normal to the axle. A strap-iron "A" frame stands on the other arm of the yoke, straddling the axle. The plate is cut away in a semicircle, and drilled to correspond with the lower half of a standard engine mounting ring. The "A" frame carries a wooden block notched out to receive a propeller shaft. The two members thus form a cradle into which an engine may be placed from an overhead hoist.

Aviation



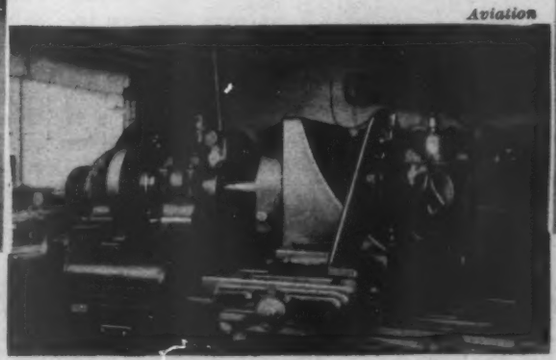
Aviation

At top: A steel tube engine buggy at T.&W.A., Kansas City. Above: The United Airports engine dolly at East Hartford.

Aviation

Buggy for handling propellers at the E.A.T. Atlanta depot.

Aviation



Right: Cylinder grinder at United's Cheyenne shop.

THE BUYERS' LOG BOOK

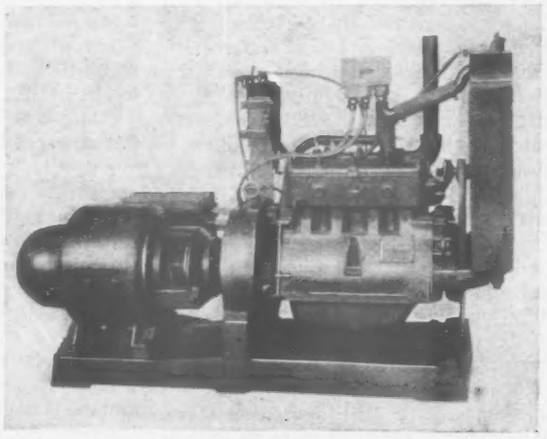
Supercharger regulator

TO RELIEVE the pilot of the necessity of continually adjusting supercharger control for various conditions of speed and altitude, the Eclipse Aviation Corporation of East Orange, N. J., has designed and marketed an automatic supercharger regulator intended to control the output of any type of supercharger, or to limit the manifold pressure in an over-compressed engine.

The total weight of the complete installation is 4 lb., 4 oz. The operating mechanism consists of two metallic bellows operating a needle valve, which maintains or releases engine oil pressure on a servo-piston connected to the inductor system or the supercharger outlet. One of the bellows with a spring inside, is sealed and evacuated to act as a pressure standard. The other is connected by a suitable pipe line to the engine intake system. The pressure differential operates the needle valve, which in turn controls the position of the carburetor butterfly valve through a suitable linkage. The hand throttle is also connected to the butterfly valve through the same system of levers. It is operated in the normal manner, the automatic regulator taking care of the engine output under various flight conditions without further attention from the pilot.—AVIATION, *November, 1932.*

M.G. sets for beacons

PYLE-NATIONAL has recently delivered 85 gasoline electric generating sets developed to meet Department of Commerce requirements for power at airway beacon sites. The Type AG power units have a capacity of 3 kva. at 110 volt, 60 cycles. They consist of a Type H2 Continental four-cylinder engine direct connected to a Pyle-National generator. The set operates at 1,200 r.p.m. under a governor control. Automatic control devices start and stop the set in predetermined regular daily cycles. In case of failure of the automatic apparatus, the unit may be controlled by means of a manually-operated switch. According to the Department of Commerce requirements, the set automatically starts whenever the cooling water temperature drops below 50 deg. F. It will then start and operate long enough to warm the water up to 120 deg. F., when it will shut off and stand until the temperature again falls to 50 deg.—AVIATION, *November, 1932.*



The Pyle-National M.G.

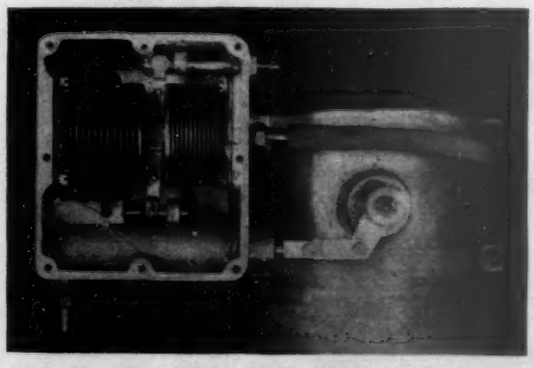
Pretuned radio

THE Western Electric Company has recently announced a new line of radio telephone equipment for aircraft. The new system provides for the shifting from one predetermined frequency to another by simply pulling a lever in the pilot's cockpit. It will no longer be necessary for a radio mechanic to readjust the transmitter and receiver on the ground when a shift, say from day to night frequency, is desired.

The transmitter is arranged to operate on any of three pre-selected frequencies. A quartz crystal oscillator is used to maintain the stability of the transmission. The antenna coupling unit which was formerly made up separately and installed at the base of the transmitting antenna has been incorporated as a part of the new transmitter unit.

The receiver is of the superheterodyne variety, and is designed for rapid frequency shift between two prearranged frequencies. As in the transmitter, the receiver frequency stability is maintained by quartz crystal oscillators, although a slight modification in the set permits the installation of electrical oscillation if crystals are not desired.

All parts of the system have been designed with an eye toward accessibility and easy servicing. Each unit is readily removable, and is connected to the permanent wiring of the airplane by jack and plug connections. Improvements have also been made in the microphone and head sets to eliminate distortion of the voice and to minimize the effect of heavy bursts of static. The new equipment is approximately the same weight as the older types, and its over-all dimensions are such that the new units will fit in the space provided for models they replace.—AVIATION, *November, 1932.*

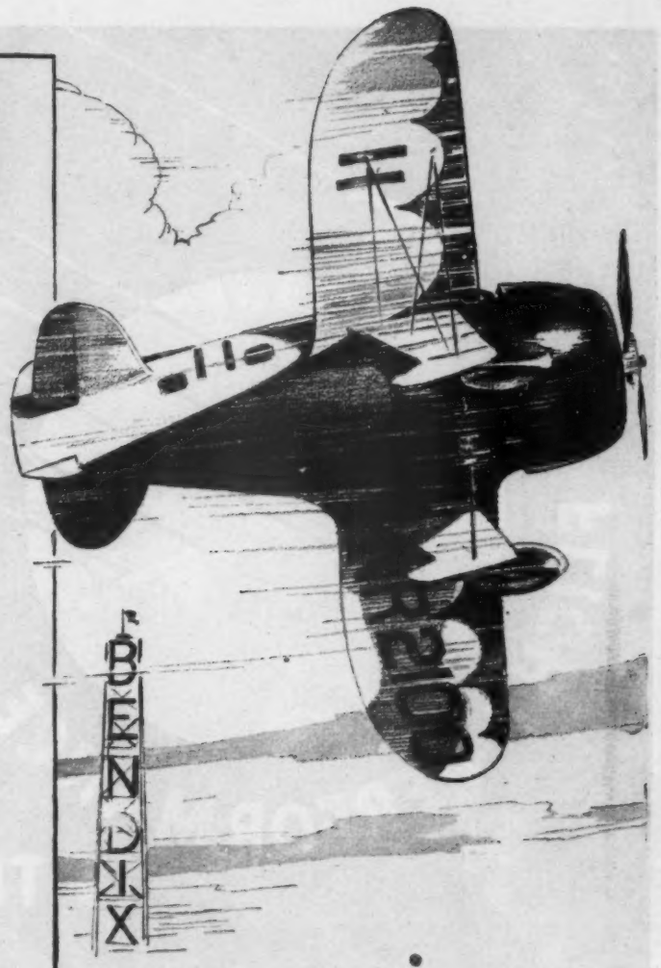


Eclipse automatic supercharger regulator.

Bendix shock strut

THE Bendix Brake Company, subsidiary of Bendix Aviation Corporation, has recently announced the Pneudraulic Shock Strut designed not only to take care of landing loads, but incorporating also a snubbing device that reduces rebound to a minimum. Impact shocks are absorbed by a flow of oil through an orifice, and taxiing shocks are taken care of largely by air compression. The snubbing device may be so set that the natural period of tire rebound may be almost instantly damped out by the action of the struts controlled by the snubber. The manufacturers claim that the new strut is more compact and lighter than the older type.—AVIATION, *November, 1932.*

Speed Kings



Right: Major James H. Doolittle's "Bumble Bee," built by Granville Bros. Winner of Thompson Trophy Race at 252.686 m. p. h. New landplane record of 296.287 m. p. h.

Below: Capt. James G. Haizlip's Wedell-Williams Special. Winner of Bendix Trophy Race, Los Angeles to Cleveland in 8 hrs. 19 min. 45 sec. New transcontinental record of 10 hrs. 19 min. 4/5 sec.

These pilots, masters of the air, can well be proud of their achievements. The ships, thoroughbreds of the sky, are compliments to American aviation. Though reduced in size and weight—stripped of all but essentials—good instruments were indispensable to assure success.

Aviation—demanding precision, dependability and accuracy in instruments—knows how to get them. Whatever the conditions—

depend on PIONEER

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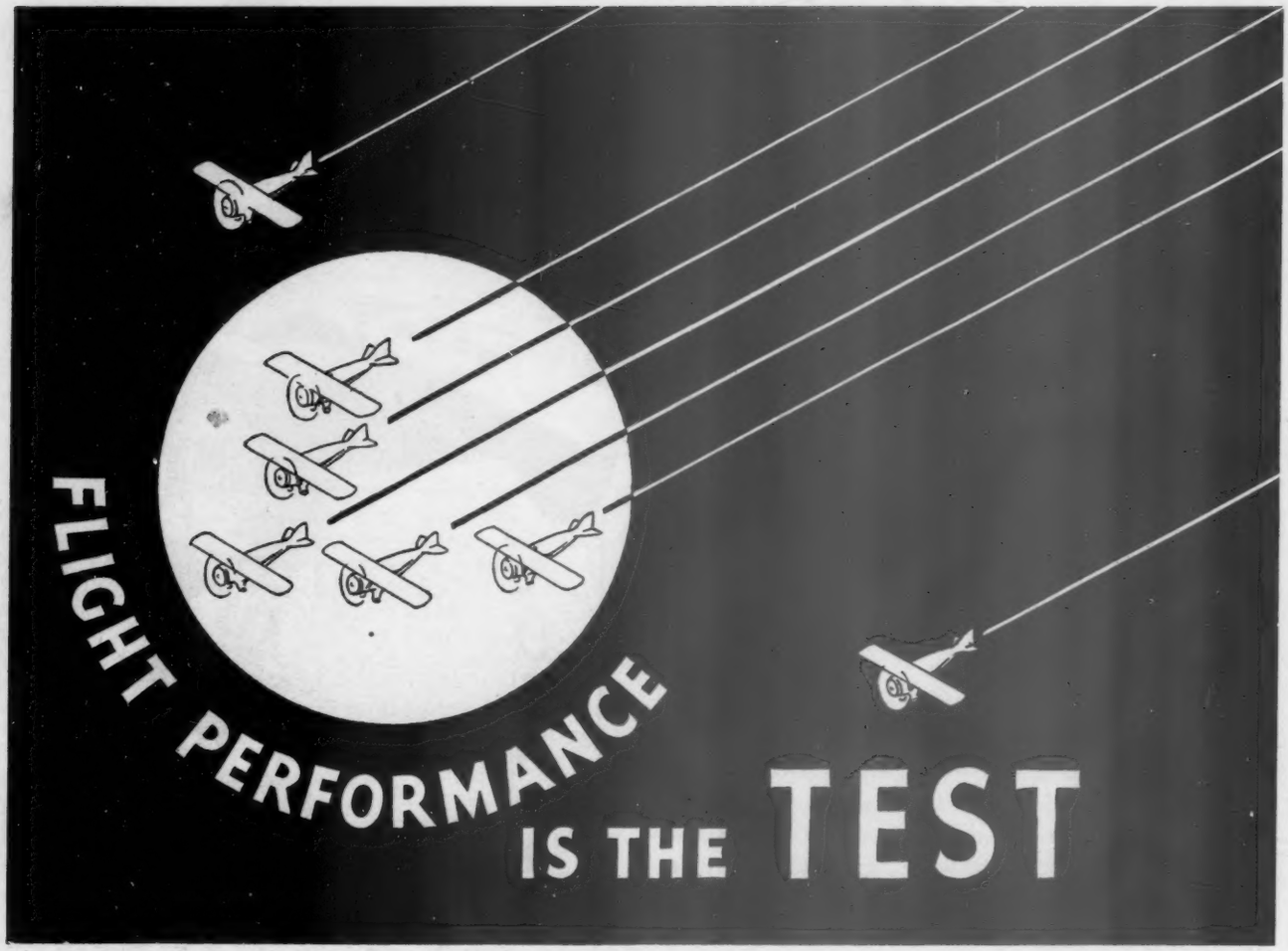
754 LEXINGTON AVENUE — BROOKLYN NEW YORK

BENDIX BLDG., LOS ANGELES 15 SPEAR ST., SAN FRANCISCO 5214 W. 63RD STREET, CHICAGO

GENERAL EUROPEAN REPRESENTATIVE, M. CALDERARA, 47 AVENUE DE BRIMONT, CHATOU S & O, FRANCE



There are no more trying conditions for a motor fuel. From 100 degrees or more to 50 below, from take-off to record altitude the gasoline *must* "come through."

Texaco Aviation Gasoline has an enviable record. Its distillation characteristics, purity and freedom from gum-forming elements insure the highest degree of safety, speed and power in the air.

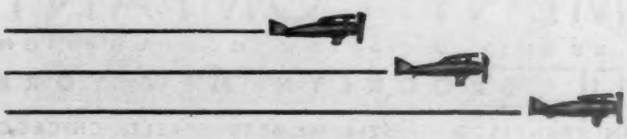
Actual flight performance is the test. Flight performance has proved the outstanding engine work of Texaco Aviation Gasoline under every condition.

Texaco Aviation Gasoline and other Texaco Aviation Products are available at principal airports throughout the country. Write The Texas Company about aviation fuels and lubricants and ask about Texaco engineering service.

THE TEXAS COMPANY • 135 East 42nd St., New York City

TEXACO

TEXACO AVIATION GASOLINE
TEXACO AERODIESEL FUEL
TEXACO AIRPLANE OILS
TEXACO MARFAK GREASES
TEXACO ASPHALT PRODUCTS
(for hangar floors and aprons and dust laying)



THEY PUT

MORE FLYING DAYS

ON YOUR WINTER CALENDAR

WHEN you're trying to maintain winter schedules, it's a great help to have a ship on Airwheel* Tires.

Because they'll bring you down safely on snow—because they'll stay on top when you land on mud—because they'll roll softly and smoothly across frozen ruts — because they prevent ground loops in cross-wind or down-wind landings — they guard you from most of the hazards that winter flying held in the past.

Don't judge these big, soft, rolling rubber cushions by any ordinary balloon tire or "semi-soft" tire you may see.

Don't miss their advantages by saying, "No tire can be as good or do as much as that."

You'll find Airwheel equipment today on passenger ships—mail planes—military planes — commercial planes — racing planes — and the private craft of a long list of veteran pilots.

Don't risk another winter without them. Find out now what they can do for you. Write to Goodyear, Akron, Ohio, or Los Angeles, Calif.

*** IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL!**

AIRWHEEL *is Goodyear's trade-mark, registered in the U. S. A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of* **AIRWHEEL** *Tires*

WHEN YOU BUY A NEW SHIP SPECIFY GOODYEAR AIRWHEELS

GOODYEAR

AUTOGIROS ARE A FAMILIAR SIGHT ON THE PACIFIC COAST. THIS IS A KELLETT MODEL

Autogiro News

PORTLAND, OREGON. The call for bids for a new contract for fire patrol duty between Seattle and Wenatchee specifies Autogiro service. The ability of the Autogiro to fly slowly with safety at lower altitudes and even hover momentarily, insures the detection of many small fires missed in the past by conventional airplanes.

ARMONK, N. Y. Westchester County's Aviation Country Club opened with a gathering of notables from the Eastern Seaboard, professional pilots and private owners. Indicative of an increasing interest and use is the fact that eleven Autogiros were present.

RIO JANEIRO. The first Autogiro to be owned in South America, Kellett K3 model, was recently received here by Mr. Antonio Seabra.

MANAGUA, NICARAGUA. The first Autogiro brought to Central America by the United States Marine Corps recently went into service at Managua, Nicaragua. This is one of three Pitcairn Autogiros purchased by the U. S. Navy.

PHILADELPHIA. Earle Eckel, pilot of a Pitcairn Autogiro, reports over fifteen hundred passengers flown within a few months' period. "A careful record shows," he says, "that 60% of these had never flown in any type of aircraft." Among his other duties, Mr. Eckel uses this Autogiro to supervise ten gasoline service stations. As an indication of Autogiro usefulness when small landing spaces are made available within city limits, this Autogiro recently landed on and took off from the Parkway, within a few blocks of Philadelphia's business center.

When an Autogiro lands on and takes off from a city street, a New York pier, the White House lawn; when it is the first aircraft to descend into the Yosemite Valley, land and fly out again; when another explores the almost inaccessible Mayan Ruins, it is spectacular and every one reads or hears about it. Much more significant proof, however, of the importance of the Autogiro is that so many of them are flying day in and day out in a wide variety of useful services. Space permits mention of only a few of these daily Autogiro activities.

AUTOGIRO

AUTOGIRO COMPANY OF AMERICA · PITCAIRN FIELD · WILLOW GROVE, PA.

EVEN TO CRANKING the Planes!

BLUEBIRD AIR SERVICE uses this "Caterpillar" Tractor as "self-starter" for airplane engines! An ingenious attachment to its power take-off enables the "Caterpillar" to turn the plane's engine gradually or to spin it vigorously—as the need may be! It's a safe, easy and effective method for the mechanic.

Nimble, versatile "Caterpillar" Tractors are handling an unusual range of duties at modern airports—helping in scores of ways to make air traffic safer, more punctual and more profitable.

Caterpillar Tractor Co., Peoria, Ill., U.S.A.
Track-type Tractors Combines Road Machinery
(There's a "Caterpillar" Dealer Near You)

Prices—f. o. b. Peoria, Illinois

FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$4350
DIESEL	$6500		

CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR

GUS and OLE . . **. . the STANAVO boys**

Sludge-o!...Gone-o!...Stanavo!

There is no mysticism behind the efficient performance of Stanavo Aviation Engine Oil. By searching experiments and actual service tests, Stanavo engineers keep in close contact with the constantly advancing requirements of modern aviation engines.

Stanavo products are always abreast of the times.

STANAVO
AVIATION GASOLINE AND ENGINE OIL

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Vast Resources—High Craftsmanship—Far-sighted Vision—BENDIX

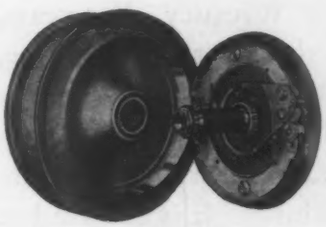
Nobody deliberately and knowingly buys inferior equipment for aircraft, where quality and fine performance are so necessary—yet there's no argument that certain products are *better* than others.

In the face of unrelenting pressure to reduce quality, Bendix believes that Aviation is best served by building every product as nearly perfect as possible; aiming at superlative performance.

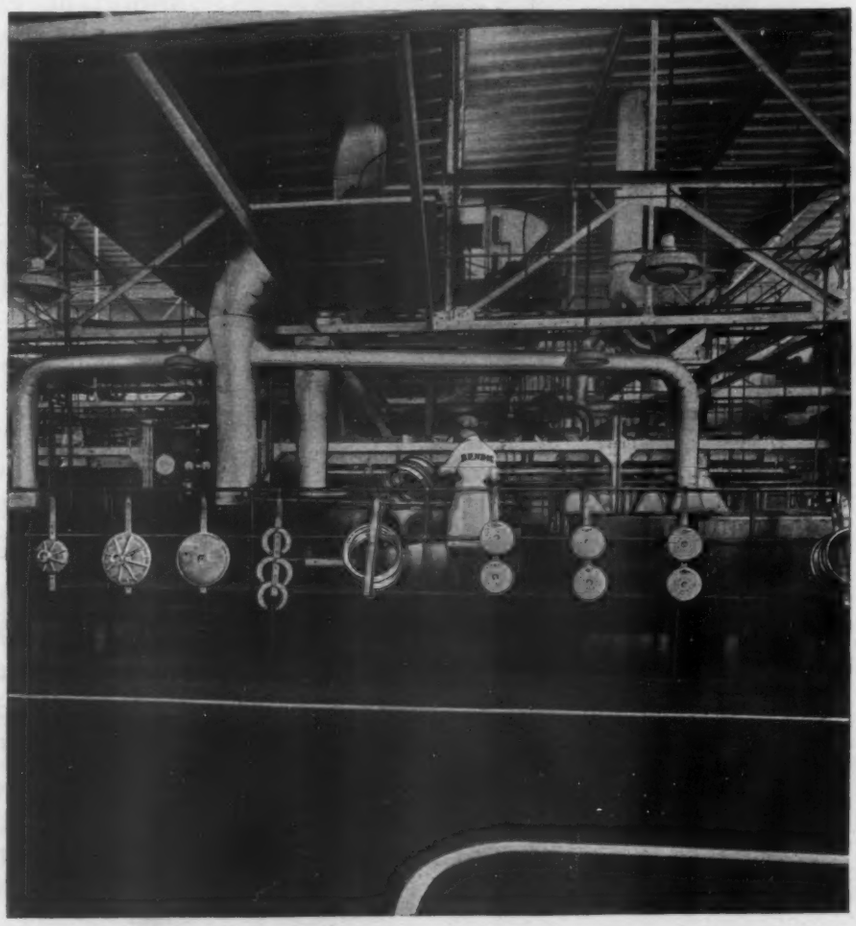
Bendix Wheels and Brakes for airplanes and the new Bendix Pneudraulic Shock Strut are examples of how vast resources, high spirit of craftsmanship, and far-sighted vision may all be inspired by a single idea—a determination to produce "the best."

And typically Bendix is the development of special and exclusive machinery used in their manufacture; contributing to superior quality and lower costs.

The services of Bendix' corps of competent engineers are always available for consultation.



The pioneer product of their kind, and standing today as always for preeminence in quality, Bendix roller bearing Wheels are the standard type for military and civilian planes. Permanently improved braking, exact concentricity of brake and drum, reduced take-off run, ease of taxi-ing and improved ground handling are obvious advantages.



Another Bendix contribution to comfort and safety—the Bendix Pneudraulic Shock Strut. Impact loads absorbed by oil flow and air compression above the oil; taxi-ing loads by air compression. Rebounds definitely controlled by snubber.

Chromic Acid Electrolitic Treatment—Developed to give the best possible protective coating for aluminum alloys. Not only does this treatment give a protective coating, but it provides the best surface yet found on the material for painting. All Bendix wheels and brakes for Naval or amphibian work are thus treated.

BENDIX BRAKE COMPANY · South Bend, Indiana

(SUBSIDIARY OF BENDIX AVIATION CORPORATION)

THE SKF GALLERY OF DISTINGUISHED PERFORMANCE USERS:

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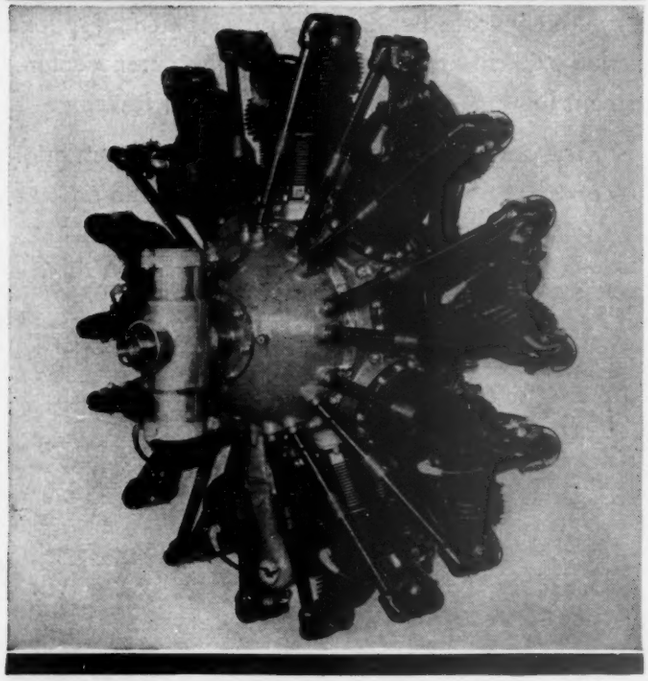

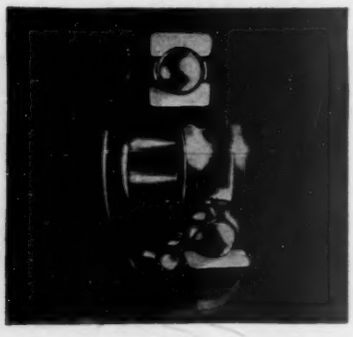

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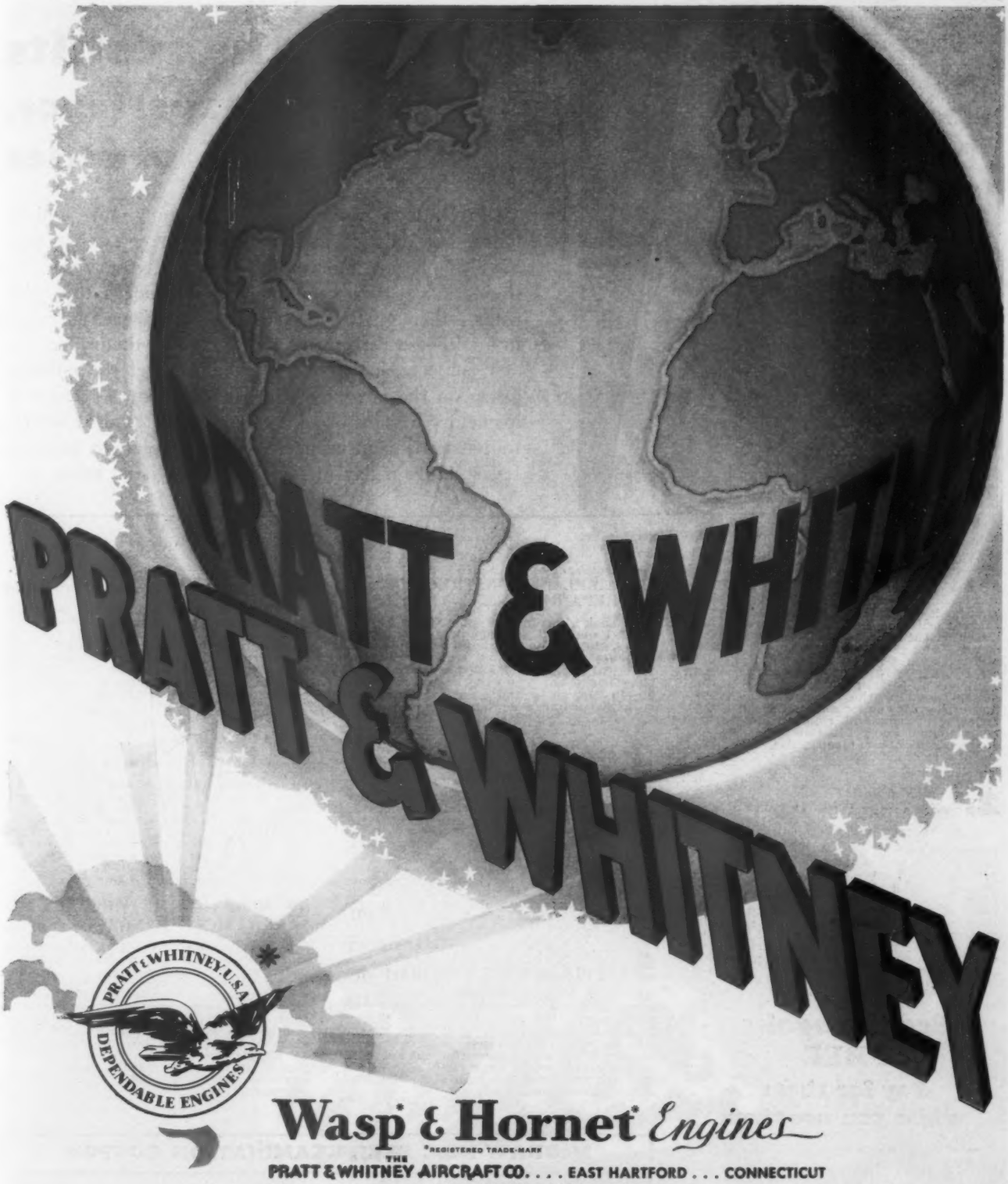

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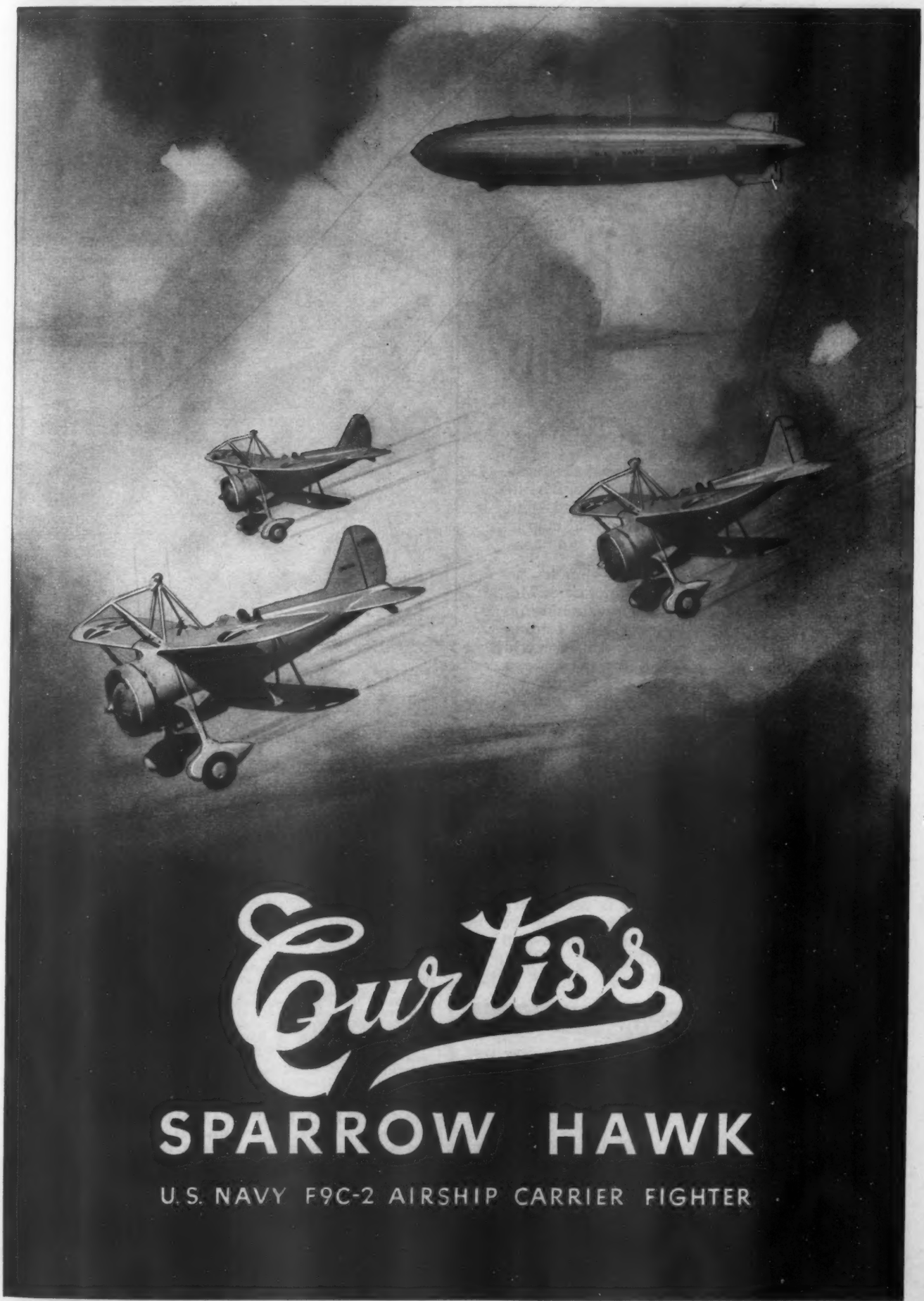
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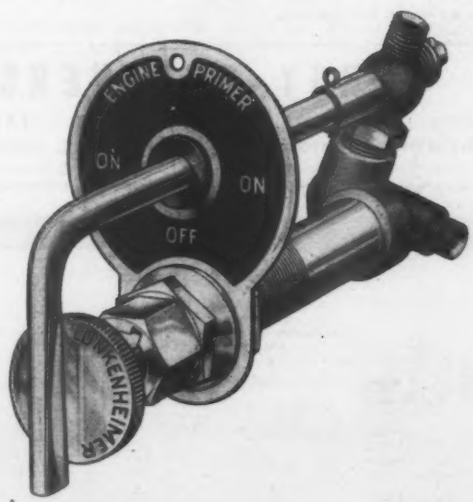

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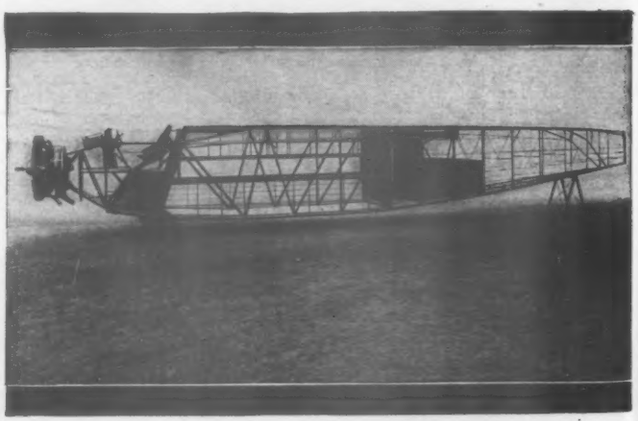

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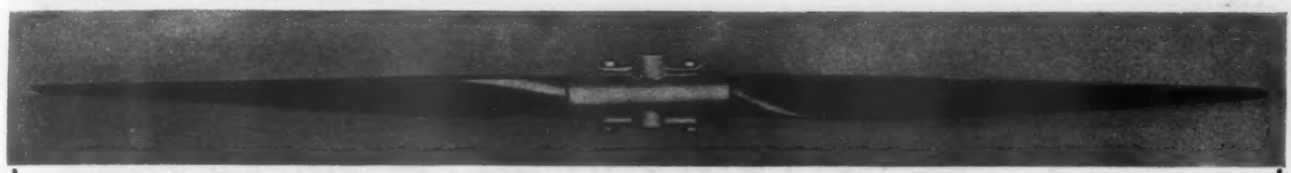

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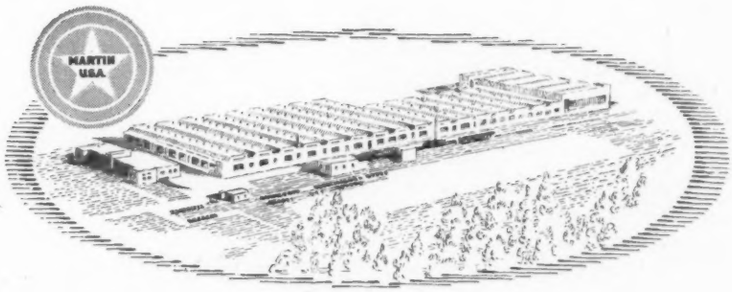

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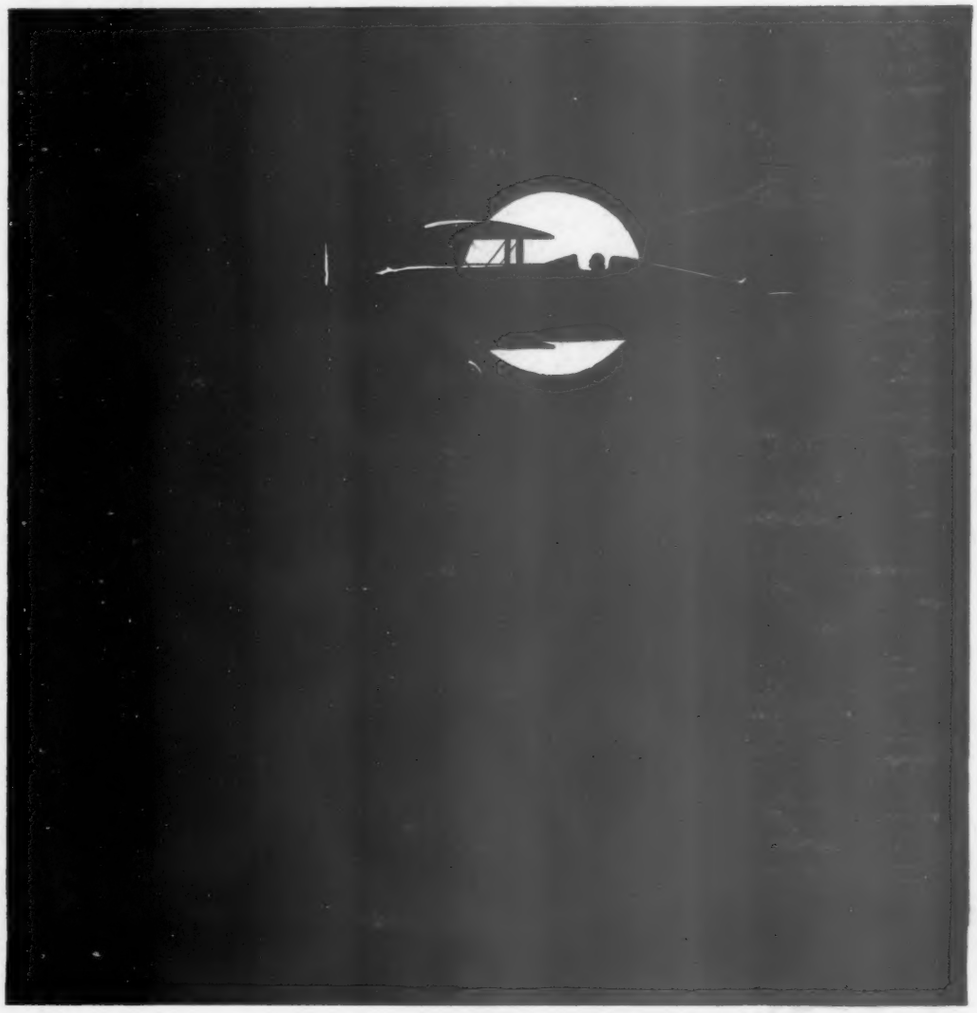

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